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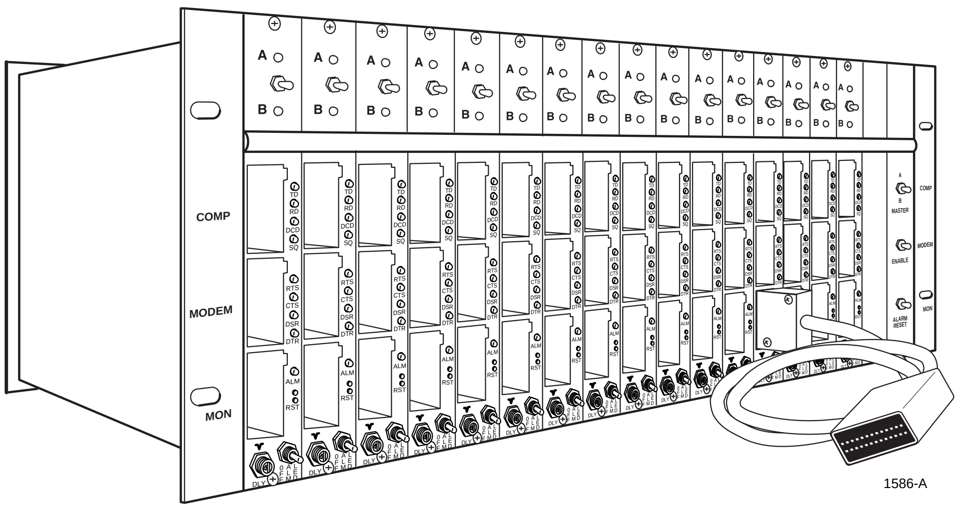
Telecommunications

RS-232/V.24, X.21 and V.35 PatchSwitch User Manual



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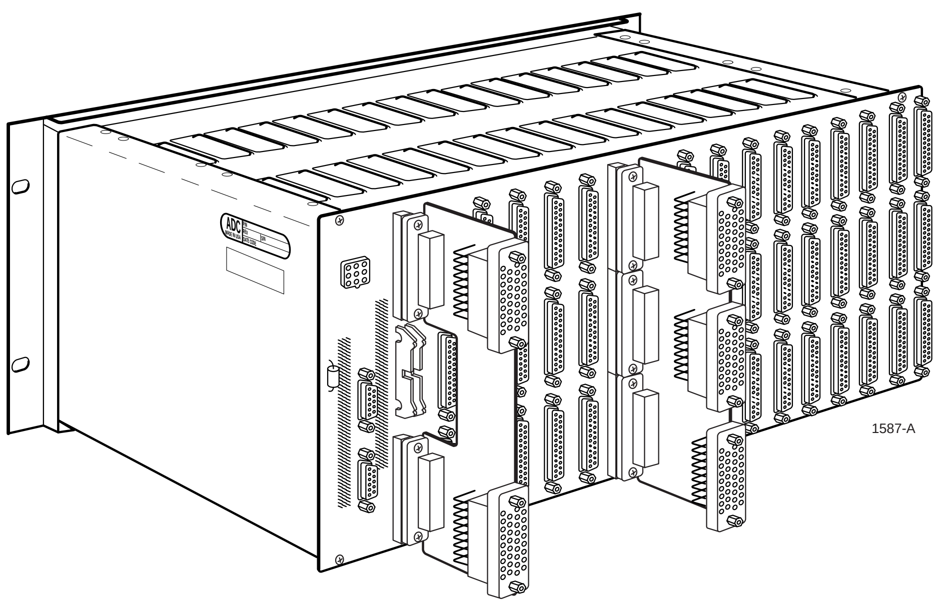

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GENERAL INFORMATION

REVISION HISTORY

EDITION/ISSUE	DATE	REASON FOR CHANGE
1st Edition, Issue 1	02/83	Original.
1st Edition, Issue 2	03/83	Technical changes.
1st Edition, Issue 3	03/83	Warranty changes.
1st Edition, Issue 4	07/83	Technical changes.
2nd Edition, Issue 1	02/84	Incorporation of remote control.
2nd Edition, Issue 2	10/84	Technical changes.
3rd Edition, Issue 1	03/86	Incorporated PSM-12 and PSM-13 Test Modules.
3rd Edition, Issue 2	05/86	Edited Communications Network Interface Connections paragraph for clarification and corrected connectors designations in Figure 4-1.
4th Edition, Issue 1	07/86	Incorporated PSM-12 and PSM-13 Test Modules. Added autofailback feature and super chassis selection (SC command) to Remote Control Module, status response for TLK (terminal) selection, and Vertical interlock to PSM-01, PSM-02, and PSM-03. Added PSM-04, PSM-05 Patch Modules with off-line access, and RS-422/RS-232 Data Converter Module.
5th Edition, Issue 1	12/86	Delete references to PSM-14 CTRL Module.
6th Edition, Issue 1	06/88	Technical changes and clarification.
7th Edition, Issue 1	10/88	Added V.35 modules and conversion boards.
7th Edition, Issue 2	08/89	Changed Figure 3-6.
8th Edition, Issue 1	05/90	Added new information on PSM-15.
8th Edition, Issue 2	06/90	Changed DIP Switch Settings in Figure 5-3 and in Control Module DIP Switch Settings paragraph.
9th Edition, Issue 1	09/91	General technical changes and added X.21 modules.
9th Edition, Issue 2	05/92	Added DMPS-10 Power Supply.
10th Edition, Issue 1	03/93	Added DC control.
Issue 19	06/99	Update to current format standards.

ABOUT THIS MANUAL

This user manual describes the RS-232/V.24 and V.35 PatchSwitch equipment. The manual provides information necessary to install and operate these units. The manual is intended for use at communications network facilities and users who monitor and maintain the network. Section 1 provides a general description of the ADC equipment. Section 2 provides a functional description of the equipment components. Section 3 provides a complete description of V.35 modules. Section 4 provides a description of X.21 modules. Sections 5 and 6 describe the equipment site preparation and installation. Section 7 describes the operation of the equipment. General Information Section explains the equipment warranty, repair/exchange policy, charges, replacement/spare parts, returned material and customer support services.

Portions of the Patch Modules are covered by U.S. Pat. No. 4,363,941 and corresponding foreign Letters Patent.

RELATED PUBLICATIONS

Listed below are all the related manuals, their content, and their publication numbers. Copies of these publications can be ordered by contacting the ADC Technical Assistance Center at 1-800-366-3891 (in U.S.A. or Canada) or 612-946-3000, extension 3223 (outside U.S.A. and Canada.

Title	ADCP Number
Network Control Products Catalog	517
PatchSwitch Remote Control Unit User Manual	ADCP-50-302
PatchSwitch V.35 Installation and User Guide	ADCP-50-311
Remote Test Access (RTA) Espion 500 System User Manual	ADCP-50-100
Remote Test Access (RTA) System User Manual	ADCP-50-101

ADMONISHMENTS

Important safety admonishments are used throughout this manual to warn of possible hazards to persons or equipment. An admonishment identifies a possible hazard and then explains what may happen if the hazard is not avoided. The admonishments — in the form of Dangers, Warnings, and Cautions — must be followed at all times. These warnings are flagged by use of the triangular alert icon (seen below), and are listed in descending order of severity of injury or damage and likelihood of occurrence.

Danger: *Danger is used to indicate the presence of a hazard that **will** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*

Warning: *Warning is used to indicate the presence of a hazard that **can** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*

Caution: *Caution is used to indicate the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided.*

GENERAL SAFETY PRECAUTIONS

⚠ **Danger:** *To prevent electrical shock, never install telephone equipment in a wet location or during a lightning storm. When installing or modifying telephone lines, disconnect lines on the network side before working with uninsulated lines or terminals.*

⚠ **Danger:** *The chassis must be properly grounded to ensure equipment and human safety.*

⚠ **Danger:** *Electric modules can be damaged by electrostatic discharge (ESD). Before handling modules, wear an anti-static discharge wrist strap to prevent damage to electronic components. Place modules in anti-static packing material when transporting or storing. When working on modules, always place them on an approved anti-static mat that is electrically grounded.*

FCC COMPLIANCE STATEMENT

This product has been certified to comply with the requirements for class A computing devices per part 15 of the FCC regulations.

⚠ **Danger:** *This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the user manual, may cause interference to radio communications. It has been tested and found to comply with limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.*

SECTION 1: INTRODUCTION

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1 GENERAL

ADC PatchSwitch Digital Patching with RS-232/V.24, X.21, and V.35 Switching equipment, hereinafter referred to as PatchSwitch or PS, provides convenient access to RS-232 (ANSI/EIA-232) or CCITT V.24, X.21, or V.35 circuits for patching or switching to allow monitoring, testing, and reconfiguring of a communications network. The V.35 description is located in Section 3. The X.21 description is located in Section 4.

Note: The PatchSwitch equipment described in this manual conforms to EIA/CCITT (RS-232/Recommendation V.24), interface between Data Terminal Equipment (DTE) and Data Communication Equipment (DCE) known as the Serial Binary Data Interchange or SBDI.

The PatchSwitch product line is a flexible, modular system providing the following features:

1. Monitoring of digital communications leads without circuit interruption;
2. Line access and switching on data communications circuit directed toward two (A/B) equipments at the DTE end and as directed toward the modem at the DCE end;
3. Loss of monitored signal alarming circuits which identify the down circuit with either or both visual and audible indications;
4. Optional signal monitoring and alarming of eight different RS-232 signal lines;
5. Optional interlocking in groups of two to 16 modules with A/B switching;
6. Optional interlocking in groups of two to 16 chassis with A/B switching;
7. Optional test module with three (3) RS-232 female ports for convenient interface with compatible test equipment, with or without lead status monitoring LEDs (8-leads monitored);
8. Flexibility of the modular system approach allows the addition of chassis and modules and the interchange of modules on a single line basis;
9. Module replacement or removal with no need for rear cable disconnection;
10. All female DTE and DCE connectors or female DTE and male DCE connectors;
11. High density chassis occupies 7 inches (17.78 cm) in height within a standard 19-inch (48.26 cm) wide rack;

12. Remote switching and alarm control operation up to 1,000 feet away from the PatchSwitch chassis rack;
13. Remote operator control via serial data communications circuits employing either RS-232, RS-422 or V.35 standards;
14. Optional autofallback to either A/B switch position on detection of an alarm;
15. Local or remote bank switching using manual or serial control;
16. 0, +5V and –5 to –48 Vdc pulse controlled bank switching, and
17. Direct test access to off-line devices.

2 PURPOSE AND SCOPE

The purpose of this manual is to provide the user with information necessary to install and operate the PatchSwitch equipment. Section 1 is a general description of the PatchSwitch equipment.

2.1 PatchSwitch Assembly Configurations

Prepackaged standard product PS assemblies are configured as listed in Table 1-1. All assemblies contain 16 PS modules in the leftmost 16 positions of the 18 position chassis. The 17th position contains a blank panel and the 18th position contains the PS Chassis Control Module. Each of the 16 modules provides patching and/or A/B (A channel DTE or B channel DTE) fallback switching for all 23 leads of an RS-232/V.24 or V.35 circuit. Bank switching, switching operation enable, and master alarm reset are all provided for in the Control Module of the PS Chassis. Each module may be configured as part of an interlocked group.

Only one module of an interlocked group can be in the B state at one time. Each assembly has a blank designation strip for operator labeling of the circuits. The PS assembly has two main functions. First, it allows a user to select from two DTE channels to be connected to a DCE. Secondly, it allows the user to monitor and restore data channels through the use of manual patching. The PS assembly gives positive indication of the current DTE channel in use and allows the operator to switch all 16 channels in the PS assembly with a single switch (bank switch). With user selectable serial remote control, the switching function can be located up to 1,000 feet away for the PS chassis assembly. With user selectable dc controlled bank switching, the bank switching function can be located up to 500 feet away.

The Interlocked group feature protects a device used as a substitute. A spare device may be connected to the DTE-B port of several A/B switching modules as shown in Figure 1-1. The A/B Interlock Jumper of each module in the group must be in the same position. When one device fails, the spare device may be substituted. Now, If another device fails, the interlocked group feature prevents the spare from being substituted for the second failed device.

Table 1-1. PatchSwitch (PS) Assembly Configurations

ADC NUMBER	DESCRIPTION	CHASSIS MODULES	CHASSIS* WITH CONTROL MODULE ONLY
PSA-01	RS-232 16 Line LED/Alarm Patching with A/B Switching (Female DTE/DCE Connectors)	16 PSM-01 1 PSM-09	RDC-01
PSA-02	RS-232 16 Line LED/Alarm Patching with A/B Switching (Female DTE and Male DCE Connectors)	16 PSM-01 1 PSM-09	RDC-02
PSA-03	RS-232 16 Line Patching with A/B Switching (Female DTE/DCE Connectors)	16 PSM-02 1 PSM-09	RDC-01
PSA-04	RS-232 16 Line Patching with A/B Switching (Female DTE and Male DCE Connectors)	16 PSM-02 1 PSM-09	RDC-02
PSA-05	RS-232 16 Line A/B Switching (Female DTE/DCE Connectors)	16 PSM-03 1 PSM-09	RDC-01
PSA-06	RS-232 16 Line A/B Switching (Female DTE and Male DCE Connectors)	16 PSM-03 1 PSM-09	RDC-02
PSA-07	RS-232 16 Line LED/Alarm A/B Switching with Off-Line Patch Access (Female DTE/DCE Connectors)	16 PSM-04 1 PSM-09	RDC-01
PSA-08	RS-232 16 Line LED/Alarm A/B Switching with Off-Line Patch Access (Female DTE and Male DCE Connectors)	16 PSM-04 1 PSM-09	RDC-02
PSA-09	RS-232 16 Line A/B Switching with Off-Line Patch Access (Female DTE/DCE Connectors)	16 PSM-05 1 PSM-09	RDC-01
PSA-10	RS-232 16 Line A/B Switching with Off-Line Patch Access (Female DTE and Male DCE Connector)	16 PSM-05 1 PSM-09	RDC-02
PSA-11	V.35, 16 Line LED/Alarm A/B Switching with Off-Line Patch	16 PSM-16 1 PSM-09	RDC-01
PSA-12	V.35, 16 Line LED/Alarm A/B Switching with Off-Line Patch	16 PSM-16 1 PSM-09	RDC-02
PSA-13	V.35, 16 Line A/B Switching with Off-Line Patch	16 PSM-17 1 PSM-09	RDC-01
PSA-14	V.35, 16 Line A/B Switching with Off-Line Patch	16 PSM-17 1 PSM-09	RDC-02

* Requires Power Supply

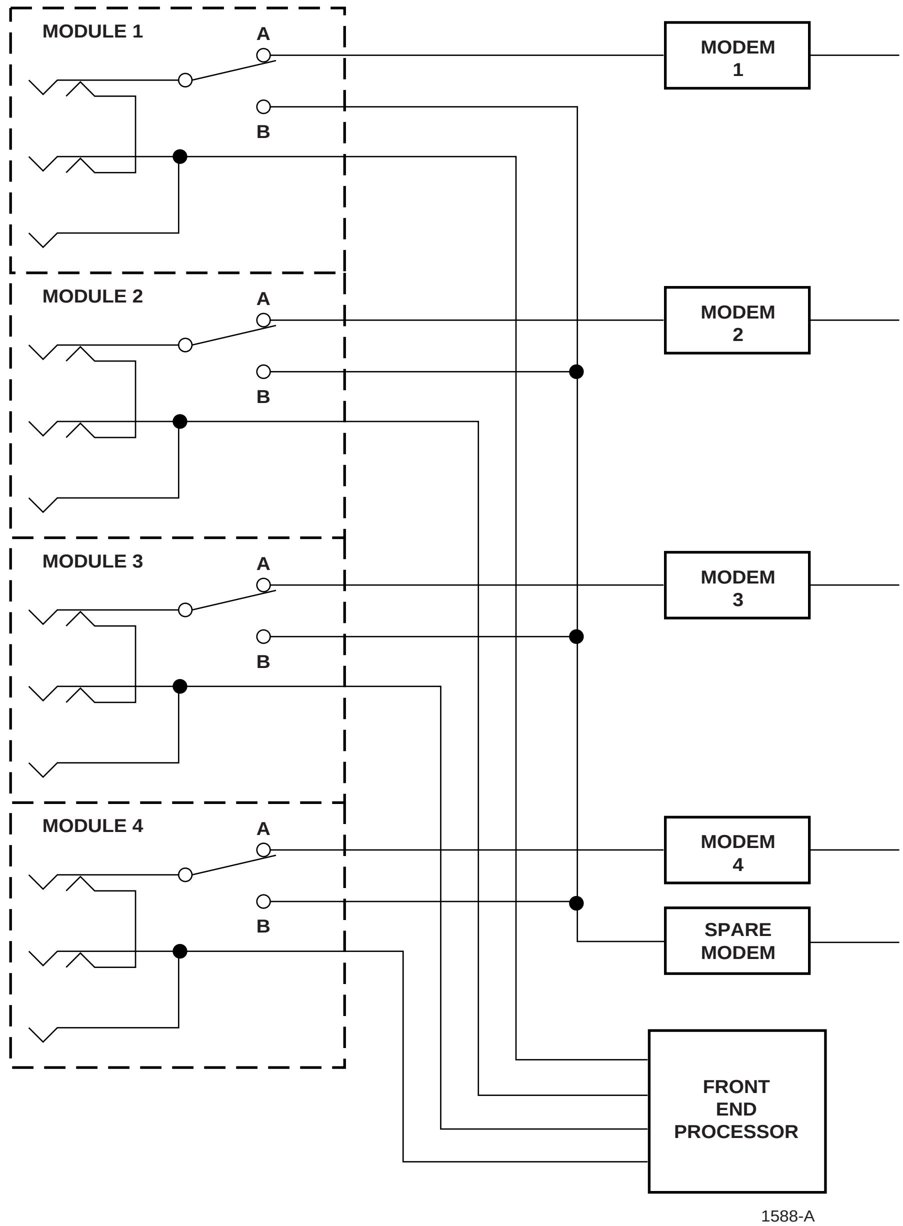

Figure 1-1. Typical Hot Spare Modem Configuration

2.2 PatchSwitch Equipment

The PS equipment consists of a chassis with a control module and associated power supply, modules forpatching and/or switching and interfacing, blank panel and patch cords. Table 1-2 lists the PS equipment.

Table 1-2. PatchSwitch Equipment
(V.35 Modules are described in Section 3. X.21 Modules are described in Section 4)

ADC NUMBER	DESCRIPTION	COMMENTS
RDC-01	PatchSwitch Chassis, 16 position	Standard rack mounted chassis which includes a control module. Requires Power Supply. Chassis can hold up to 16 PS modules and one patch interface, test data converter, or blank module. Provides female DCE and DTE connectors.
RDC-02	PatchSwitch Chassis, 16 position	Same as RDC-01 except provides male DCE connectors.
PSM-01	LED/Alarm Patch Module with A/B Switching	A/B electromechanical switching between two data communications devices; and computer, modem and monitor patching functions. Also includes RS232/ V.24 LED and Alarm functions.
PSM-02	Patch Model with A/B Switching	Same as PSM-01 except no LED and alarm functions.
PSM-03	Module with A/B Switching Only	A/B electromechanical switching between two data communications devices.
PSM-04	LED/Alarm Patch Module with Off-Line Access	Same as PSM-01 except it provides direct test access to off-line device when module is in either A or B (sub) state.
PSM-05	Patch Module with Off-Line Access	Same as PSM-04 except no LEDs or alarm.
PSM-07	LED Alarm Patch Interface	Connects one or two data ports to other test equipment via patch cords. Also includes RS-232/V.24, LEDs and alarm.
PSM-08	Patch Interface	Same as PSM-07 except no LEDs and alarm.
PSM-09	Blank Panel	Covers unused card slots.
PSM-12	RS-232/V.24 LED/Alarm Test Module	Provides an interface port for test equipment requiring RS-232/V.24 circuit compatibility. Normally positioned in slot 17 of RDC-01 and RDC-02. However, this PS module may be mounted in any slot, except for 18, of the above PS chassis. Includes eight LEDs for RS-232 lead status monitoring, an adjustable alarm and patch jack port.
PSM-13	Test Module	Same as PSM-12 without LEDs and alarm circuitry.
PSM-15	Control Module	Chassis control module permitting local, or dc pulse serial remote switch and alarm control.
PSW-000001	PatchSwitch Power Supply (6 pin in-line connector)	Dual output supply used with PSC-01/PSC-02 chassis with input power source from 90 to 240 Vac, 48-63 Hz.

Table 1-2. PatchSwitch Equipment, continued
(V.35 Modules are described in Section 3. X.21 Modules are described in Section 4)

ADC NUMBER	DESCRIPTION	COMMENTS
PSW-000002	PatchSwitch Power Supply (9 pin in-line connector)	Dual output supply used with RDC-01/RDC-02 chassis with input power source –48 Vdc.
PSW-000003	PatchSwitch Power Supply (9 pin in-line connector)	Dual output supply used with RDC-01/RDC-02 chassis with input power source from 90 to 240 Vac, 48-63 Hz.
PSR-06	Data Converter Module	Converts signals to provide RS-232/RS-422 compatibility for remotely controlled PatchSwitch equipment.
PMPC-2 PMPC-3 PMPC-4 PMPC-6 PMPC-8 PMPC-10	Standard Patch Cord, 2-feet Standard Patch Cord, 3-feet Standard Patch Cord, 4-feet Standard Patch Cord, 6-feet Standard Patch Cord, 8-feet Standard Patch Cord, 10-feet	Patch cords are 26 conductor cable with ADC patching connectors on both ends. For use with PSM-01, PSM-02, PSM-04, PSM-05, PSM-07, PSM-08, PSM-12 and PSM-13.

2.2.1 PatchSwitch Chassis

The PS chassis is the standard EIA 19-inch rack mounted unit with a backplane and space for 18 modules. The early chassis (PSC-01 and PSC-02) can be identified by the six pin in-line power connector located on the back upper left corner of the chassis. The later chassis (RDC-01 and RDC-02) can be identified by the nine pin square power connector located on the back upper left corner of the chassis.

The RDC-01/02 backplane consists of a printed circuit board assembly with eighteen 96-pin connectors on the inside of the card cage and 50 D-subminiature (DB) 25-pin connectors, two (DB) 9-pin connectors, one 20-pin dual in-line (DIN) connector and one 9-pin square connector on the back of the board.

2.2.2 PatchSwitch Control Module (RDM-15B)

Manual operation of the PatchSwitch Control Module switches provides local control of the switch and alarm functions. The Control Module is microprocessor-based and provides the interfacing capabilities for both manual, dc pulse bank switching and remote control operations. A four-position DIP switch on the Control Module encodes the chassis identification number. Remote control devices use this number to select the PS chassis (see Table 6-1). The Control Module is located in position 18 (slot 18) of all PatchSwitch chassis.

2.2.3 Data Converter Module (PSR-06)

This module is a printed circuit board assembly with components, a front panel with four LED status indicators and a rear 96-pin DIN connector. The module interfaces with the ADC Remote Control Unit, a user's CRT terminal, or computer, and converts signals providing RS-422/RS-232 compatibility to permit remote serial control for PatchSwitch equipment to be connected to RS-232 modem or CRTs.

2.2.4 LED/Alarm Patch Module with A/B Switching (PSM-01)

This PS module is a printed circuit board assembly with components, a front panel (two toggle, one rotary and one touch switch, three patch 26-pin connectors, and 11 LEDs), and rear 96-pin DIN connector. It may be mounted in any of the first 16 module positions.

2.2.5 Patch Module with A/B Switching (PSM-02)

This PS module has the same features as PSM-01 except without RS-232/V.24 lead status indicators and alarming.

2.2.6 A/B Switching Module (PSM-03)

This PS module is a printed circuit board assembly with components, a front panel (one toggle switch and two LEDs) and a rear 96-pin DIN connector. It may be mounted in any of the first 16 module positions.

2.2.7 Led/Alarm Patch Module with A/B Switching and Off-Line Access (PSM-04)

This module is the same as PSM-01 except that when it is in A or B state, the off-line port provides direct test access to the off-line device.

2.2.8 Patch Module with A/B Switching and Off-Line Access (PSM-05)

Same as PSM-04 except this module has no LEDs or alarm.

2.2.9 LED/Alarm Patch Interface (PSM-07)

This module (normally mounted in the 17th position of the chassis but may be mounted in the 1st through 16th position) is a patch interface module with LED and alarm; the model is a printed circuit board assembly with components, a front panel (one toggle, one rotary and one touch switch, two patch 26-pin connectors and nine LEDs), and a rear 96-pin DIN connector.

2.2.10 Patch Interface (PSM-08)

This module (normally mounted in the 17th position of the chassis but may be mounted in the 1st through 16th position) is a patch interface module; the module is a printed circuit board assembly with a front panel (two patch 26-pin connectors) and rear 96-pin connector.

2.2.11 Blank Panel (PSM-09)

This panel is used in chassis module positions in lieu of a module. The panel is a two piece assembly secured to the chassis by two mounting screws.

2.2.12 Test Module (PSM-12)

Test Module PSM-12 is normally mounted in the slot position 17 of the PS chassis, but may be mounted in any slot to the left of position 17 (1 through 16). This module provide the user with RS-232/V.24 interface capabilities and status monitoring for eight (8) leads and alarm conditions. The module contains three female RS-232/V.24 ports (one on the front panel and two on the rear of the module) and a patch jack. All four connectors are hardwired in parallel. The eight RS-232/V.24 leads monitored for status include: TD; RD; DCD; SQ; RTS; CTS; DSR; and DTR. Each lead contains an associated LED indicator, located on the front panel, which turns on when the signal is active (or high). An adjustable alarm circuit with associated LED (ALM) is also provided to inform the user when a preselected alarm condition exits. After an alarm conditions occurs, the alarm circuit may be reset by the operator touching the finger reset (RST) switch. A toggle switch is also provided to enable/disable the alarm LED.

2.2.13 Test Module (PSM-13)

Test Module PSM-13 is normally mounted in slot 17 of the PS chassis, but may be mounted in any slot to the left of position 17 (1 through 16). This module provides the user with interface capabilities to spare devices or test equipment. The front panel of the Test Module contains one female DB25 port and one patch jack. The rear of the module at slot position 17 contains two female RS-232/V.24 ports. All four connectors are hardwired in parallel.

2.2.14 PatchSwitch Chassis AC Power Supply (PSW-000001)

This power supply is a plug-in unit used when the power source is from 90 to 240 Vac, 48-63 Hz. This power supply has a six pin in-line connector for use with chassis PSC-01 and PSC-02.

2.2.15 PatchSwitch Chassis AC Power Supply (PSW-000003)

This power supply is a plug-in unit used when the power supply source is from 90 to 240 Vac, 48-63 Hz. This power supply has a nine pin square connector for use with chassis RDC-01 and RDC-02.

2.2.16 Standard Patch Cords (PMPC-X)

The standard patch cords used with the PC chassis modules are described in Table 1-2.

3 SPECIFICATIONS

Physical Characteristics

PS Chassis

Height:	7 inches	(17.78 cm)
Width:	19 inches	(48.3 cm)
Depth:	12 inches	(30.12 cm)

Environmental Conditions

Ambient Temperature:

Operating: +32° F to +122° F (0° C to +50° C)
Storage: –40° F to +158° F (–40° C to +70° C)

Relative Humidity:

Operating: 10% to 80% noncondensing
Storage: 5% to 90% noncondensing

Power Requirements

PS Chassis:

+5 Vdc @ 3 amps
+12 Vdc @ 1 amp (switching)

3.1 DMPS-10 AC Power Supply

The DMPS-10 AC Power Supply provides all dc operating voltages and current required by up to four fully-populated RDC-01 or RDC-02 chassis. The rack mounted power supply plugs directly into a standard 110 Vac primary power source outlet. This power supply can also be set for use with 240 Vac. The power supply comes equipped with one nine-conductor power cord and an AC line cord. The DMPS-10 will power one PS assembly and can house up to three additional DMPS-10 EXP expansion power modules to supply power for four PS chassis assemblies.

FUNCTIONAL
DESCRIPTION

SECTION 2: FUNCTIONAL DESCRIPTION

Content	Page

1 GENERAL

This section describes how the PatchSwitch equipment functionally operates in a data communications network. The PS equipment provides two main functions. A user selects one of two DTE data channels to connect to a DCE. Additionally, the user can monitor and restore data channels with a manual patch.

2 PATCHING WITH IN-LINE A/B SWITCHING

A functional diagram illustrating patching with in-line A/B switching is shown in Figure 2-1. Computer access is through the COMPUTER patch cord jack and either the DTE-A or DTE-B jack. Modem connection is through the MODEM patch cord jack and the DCE jack. Monitor connection is through the MONITOR patch cord jack.

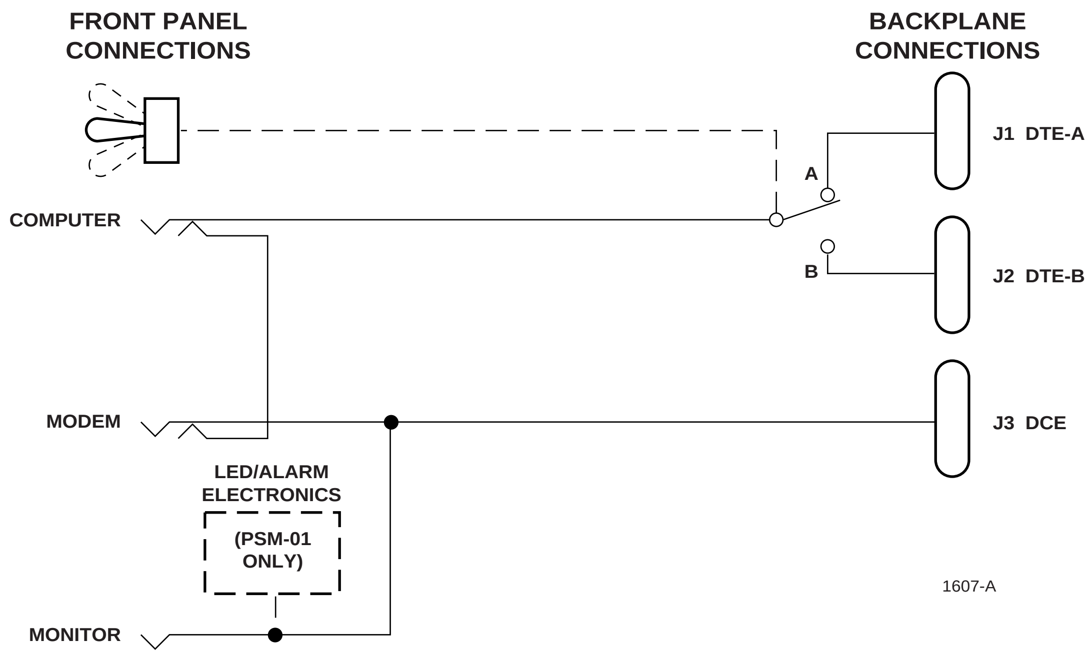

Figure 2-1. PatchSwitch with In-Line Access (PSM-01, PSM-02)

3 A/B SWITCHING WITH OFF-LINE MONITOR ACCESS

The capability for accessing the off-line DTE device is illustrated in Figure 2-2. The upper port (A) provides patch cord access to the upper "D" subminiature connector (J-1) on the chassis rear panel. When the module is in the "A" or normal state, this provides a monitor function. If the module is in the "B" or "sub" state, this provides direct test access to the off-line device.

The middle port (B) functions in the same manner for the middle connector (J-2) on the chassis backplane; "B" state, monitor access. "A" state, test access to the off-line "B" device.

The lower port (C) provides "intrusive" test access to the lower (J-3) connector on the chassis backplane. Insertion of a patch cord in this port, regardless of switch status, breaks the circuit and connects the patch cord to the common (DCE) device.

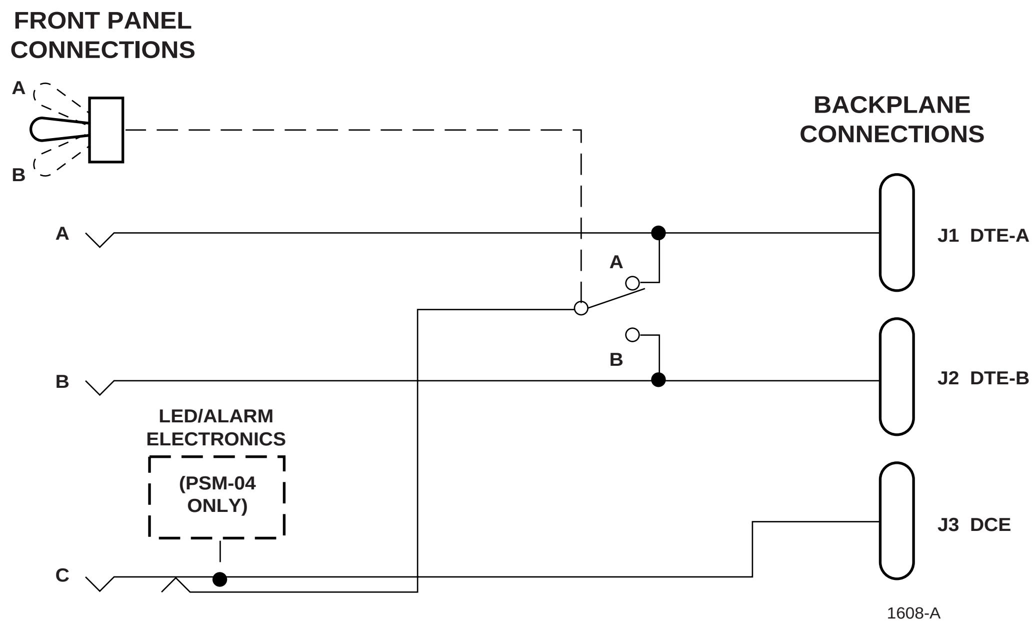

Figure 2-2. PatchSwitch with Off-Line Access (PSM-04, PSM-05)

3.1 PS Control Module (RDM-15)

The PS Control Module (CM) controls the overall manual operations of the modules contained in the PS chassis. Three toggle switches located on the front panel have the following functions:

1. Bank switch all PS modules to either the “A” or “B” position. That is, switch all modules at the same time to either the “A” position or “B” position.
2. Enable the bank switch and the individual module A/B switches.
3. Reset all of the modules' alarm circuits.

The audible alarm circuitry is in the CM. It activates when an individual PS module detects an alarm condition (according to the alarm selection configuration on the module). Alarm conditions are detected only by modules which contain circuitry. The alarm circuitry must also be conditioned by proper strapping (jumper) of the individual PS chassis module.

When the alarm condition occurs, the individual module energizes its yellow LED indicator and the CM audible alarm sounds. The operator toggles the reset switch to reset the alarm circuitry.

The PS Control Module is equipped with a selectable remote control feature. Depending on the strap position the CM will either accept serial RS-422 or dc level (pulse) signals through the 9-pin D-subminiature connector. The CM is shipped strapped for RS-422 control.

With the CM strapped for serial RS-422 remote control, the CM provides an interface between the PS chassis modules and a remote control device (see Figure 2-3 and Figure 2-4). The following devices can be used for remote control of a PS chassis.

1. PatchSwitch Remote Control Unit (RCU, PSR-03) (See ADCP-50-302 User Manual.)
2. Terminal or computer (asynchronous ASCII device).

A remote control device can control the operation of up to 16 full PS chassis assemblies (16 modules each) using a dedicated communications channel. This channel has four signals:

1. Transmit Data (TD)
2. Receive Data (RD)
3. Clear-To-Send (CTS)
4. Request-To-Send (CTS)

Each of the above signals has the same function as the corresponding signals defined by the RS-232 standard.

The communications channel transmission medium is a cable consisting of four twisted wires within an overall shield. The shield is ground potential.

Note: The electrical characteristics of the communications channel cable (9-wire) conform to RS-422A/V.11 (X.27) standards.

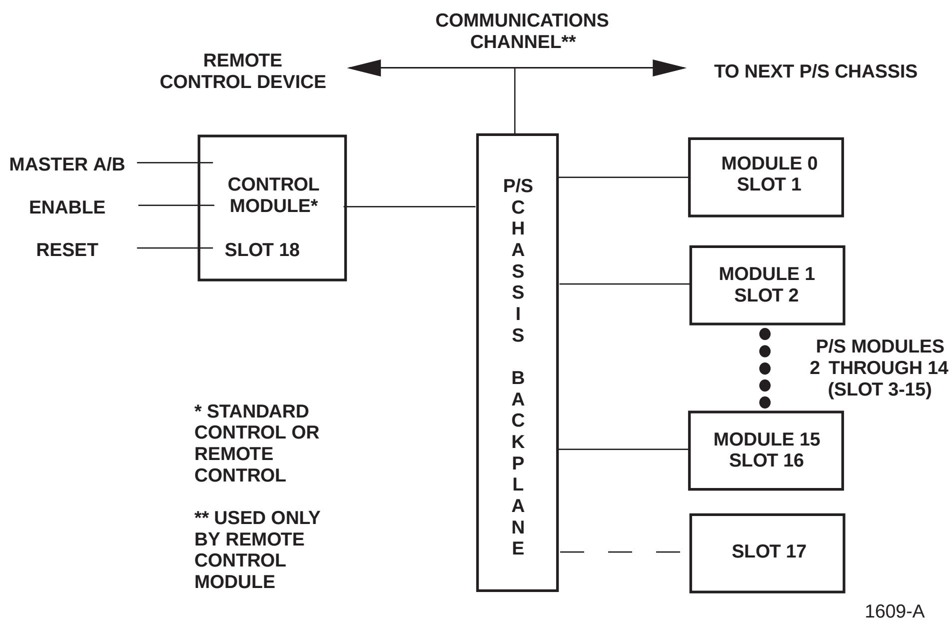

Figure 2-3. Control Module, Simplified Block Diagram (Standard and Remote)

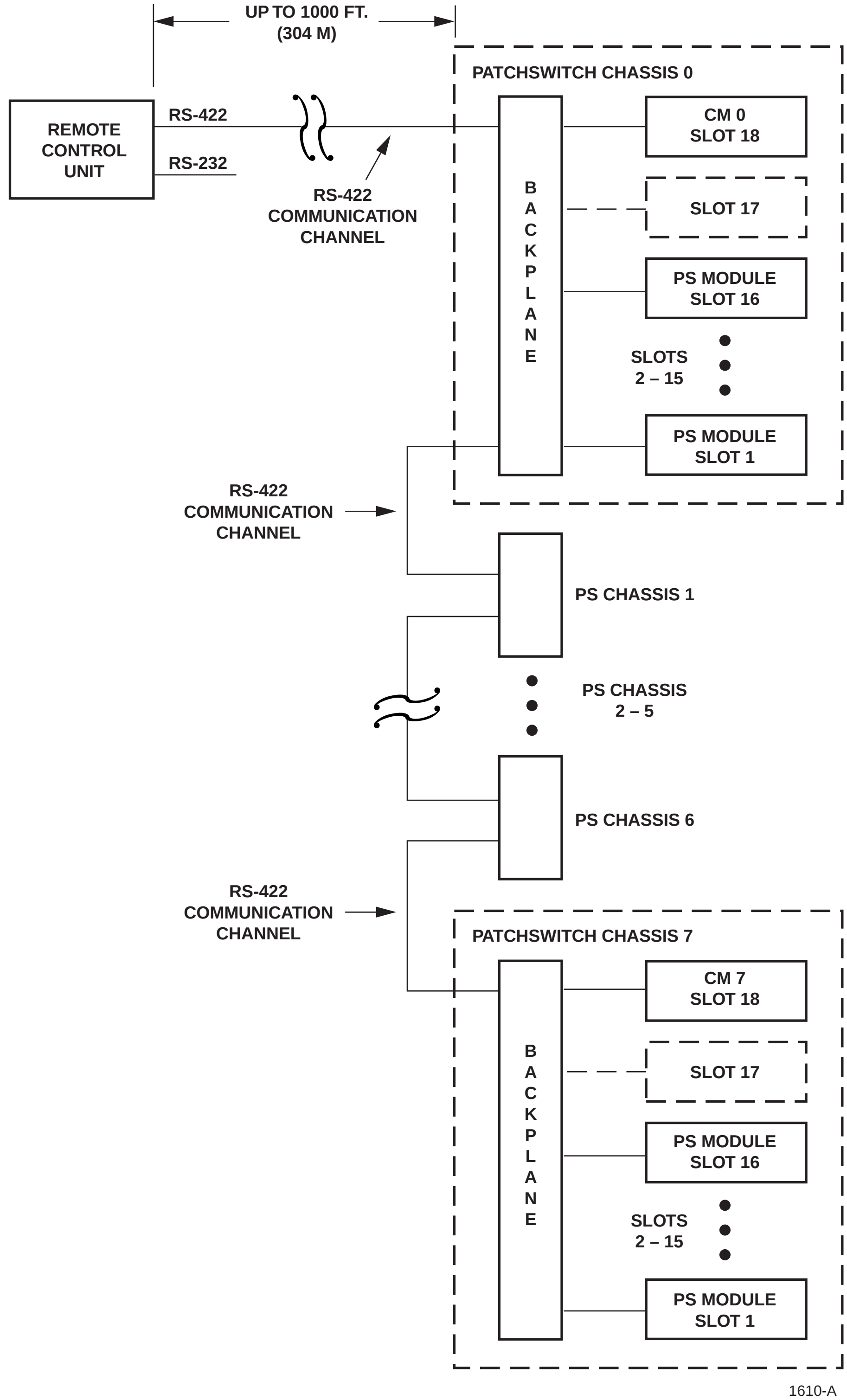

Figure 2-4. RCU to Local PatchSwtich Chassis, Interconnection Block Diagram

The cable connectors are 9-pin, D-subminiature. Both end-connectors are male. The cable may be up to 1,000 feet in length. Connector pin assignments are detailed in Table 2-1.

Table 2-1. Communications Channel Connector Pin Assignments

SIGNAL NAME	PIN NUMBER	DIRECTION OF SIGNAL
TD + TD –	6 7	Input Input
RD + RD –	2 3	Output Output
CTS + CTS –	4 5	Output Output
RTS + RTS –	8 9	Input Input
GRD	1	Ground

Each PS chassis contains two female 9-pin D-subminiature connectors wired in parallel. A cable connects one PS chassis to another in daisy-chain fashion. A long cable connects the remote control device to the first (or last) PS chassis in the chain. Up to 16 PS chassis may be interconnected via the communications cable to a remote control device.

All transmissions between the PatchSwitch Control Module and the remote control device must use the ASCII character set. The PS chassis is a DCE device and has the following data transmission characteristics:

1. Speed of 1200 bits per second
2. Asynchronous transmission
3. Bit-serial ASCII data (8 bit no parity)
4. One Stop bit.

During normal operations, only one (of the possible 16) PS chassis CM may transmit on the communications channel at one time. When a PS Chassis is selected by the remote control device, all other PS chassis connected on the same channel are disabled (de-selected). All manual controls on a CM are always functional.

With the CM strapped for dc pulse control, the CM provides capability to bank switch PS chassis modules by application of 0V (GND), +5V or –5V to –48V dc voltage levels on the 9-pin D-subminiature connector. The connector pin assignments are detailed in Table 2-2.

Table 2-2. DB-9 Pinout and Signal Characteristics

PIN	OULTAGE INPUT	CHANNEL (SWITCHED TO)
1	Chassis Ground	N/A
2	–48V +5% (–5V min)	B
3	+5V +5%	B
4	Remote Ground In	B
5	Signal Return	N/A
6	–48V +5% (–5V min)	A
7	5V +5%	A
8	Remote Ground In	A
9	Signal Return	N/A

Note: The dc voltages indicated in Table 2-2 must be present for a minimum of 250 msec to ensure switching.

Up to four (4) PS chassis can be bank switched by daisy chaining the CMs via the 9-pin D-subminiature and ensuring that each CM is strapped for dc pulse control.

The CM is also equipped with a selectable Autofallback feature. When an alarm condition is detected, automatic switching is performed between the “A” and “B” sides of the PS modules. The “A” to “B” side, or “B” to “A” automatic switching operation is selected by installing a jumper on the CM circuit board. After configuring the Autofallback option, the PS module detecting the alarm switches to the designated side (depending on the strap installed), it remains in the switched position regardless of subsequent alarm status.

Alarm indications are automatically reset after the module detecting the alarm switches to the appropriate side if the module is strapped for “Automatic Reset” (recommended). When the front panel alarm (**ALM**) selection is positioned in the **OFF** position, the autofallback feature is disabled for that module.

3.2 LED/Alarm Patch Module with A/B Switching and In-Line Patch Access (PSM-01)

This PS module provides patching and switching functions together with lead status, switch status, and alarm indications. A simplified circuit of this module is shown in Figure 2-5.

The A/B switch activates relays to connect the computer patch cord jack either the DTE-A port or the DTE-B port. The indicators show A/B switch position, alarm and RS-232 lead status.

Figure 2-6 shows a more detailed diagram of the module. In addition to switching between DTE-A or DTE-B, the relays also switch in the interlock jumper. Interlocking is used to protect the user from accidentally switching a common backup piece of equipment onto two or more different data lines. This is accomplished by allowing only the first module in that group to switch. The remaining modules remain in the “normal state” or the “A” position. Modules in the “B” position once switched to “A” will remain in the “A” position.

The three classes of interlock groups available are:

1. Global Interlock: Groups 1 and 2 are global and may be extended to all chassis in a system, using a 20-pin interchassis interlock cable. With this grouping, all modules having a jumper placed on group 1 make up one group, and all modules with a jumper on group 2 make up the other group. Interchassis interlock cables must be installed between chassis. Each module interlock group may have no more than one jumper installed at a time.
2. Horizontal Interlock: Groups 3 and 4 are horizontal and they include only modules in the individual chassis. With this grouping, all modules having a jumper placed on group 3 make up one group, and all modules with a jumper on group 4 make up the other group. These groupings do not extend out of the chassis and are not affected by the interchassis interlock cable. Each module interlock group jumper block may have no more than one jumper installed at a time.
3. Vertical Interlock: The vertical interlock jumper position is labeled V. Placing a jumper in this position interlocks all modules in the same slot location in other chassis having a jumper installed on the same V position. Interchassis interlock cables must be installed between chassis. The interchassis interlock cable is a 20 position ribbon cable (4WC-03) with a 20-pin connector for each chassis. Each module interlock group jumper block may have no more than one jumper installed at a time.

LEDs show the status of eight RS-232 leads. Each lead has a jumper connection to the alarm circuit control logic. The alarm is thus user selectable for any of eight leads. The EIA RS-232/ CCITT V.24 modem interface signal leads are shown in Table 2-3. The alarm circuit control logic supplies the alarm signal to the control module and an alarm indicator. This logic is also controlled by the RST (Reset) touch switch, toggle switch OFF (LED off, audible alarm off), ALM (LED and audible alarm on) and LED (LED on, audible alarm off), and rotary switch DLY (alarm time delay setting). The alarm may be automatically reset if the automatic alarm reset jumper is in place. LED status indicators with their color and signal definition is shown in Table 2-4. Table 2-5 shows the alarm delay settings.

⚠ **Caution:** *The bank switching feature is not compatible with the group interlock feature. If no module in an interlocked group is in the B state when a bank switch to the B state is initiated, only the first module in this group will switch to the B state. Data may be lost when more than one module is in the B state of an interlocked group. If one module in an interlocked group is in the B state when a bank switch is initiated, the rest of the modules in that interlocked group do not switch to the B state; consequently, the system maintains its integrity.*

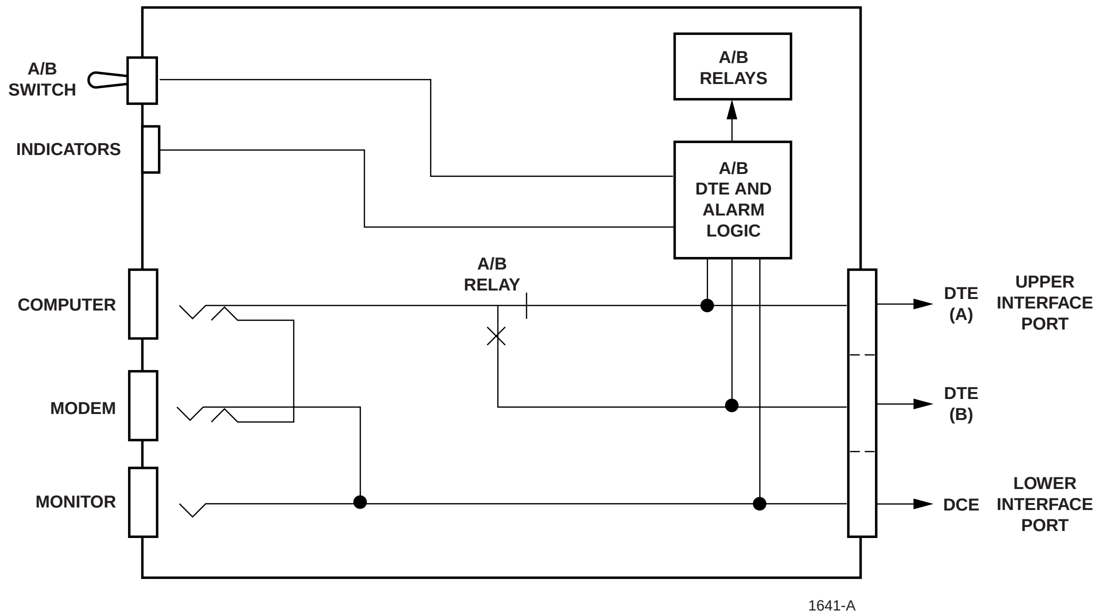

Figure 2-5. LED/Alarm Patch Module with A/B Switching Simplified Circuit Diagram

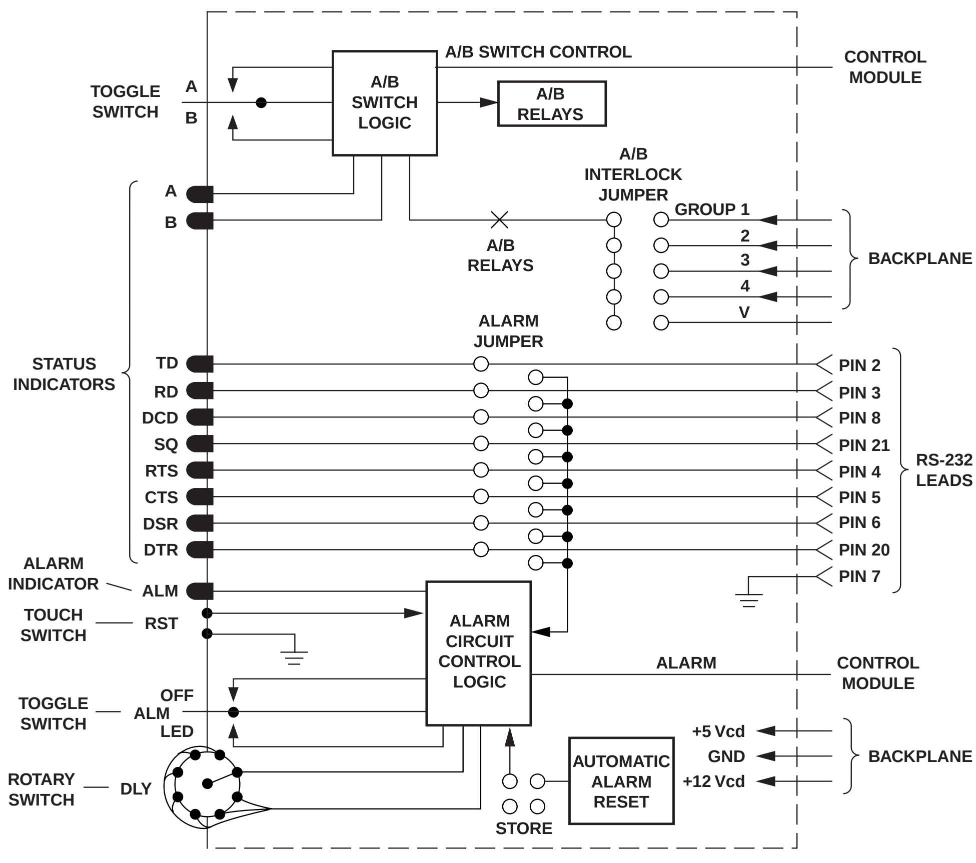

Figure 2-6. LED/Alarm Patch Module with A/B Switching Detailed Circuit Diagram

Table 2-3. RS-232 Modem Terminal Interface

PIN	NAME	SOURCE	FUNCTION	CIRCUIT CCITT/EIA
1	FG	—	Frame Ground	101 (AA)
2*	TD	DTE	Transmitted Data	103 (BA)
3*	RD	DCE	Received Data	104 (BB)
4*	RTS	DTE	Request To Send	105 (CA)
5*	CTS	DCE	Clear To Send	106 (CB)
6*	DSR	DCE	Data Set Ready	107 (CC)
7	SG	—	Signal Ground	102 (AB)
8*	DCD	DCE	Data Carrier Detect	109 (BA)
9		DCE	Positive DC Test Voltage	
10		DCE	Negative DC Test Voltage	
11				
12	SRLSD	DCE	Sec Data Carrier Detect	122 (SCF)
13	(S)CTS	DCE	Sec Clear To Send	121 (SCB)
14	STD	DTE	Sec Transmittal Data	128 (SBA)
15	TC	DCE	Transmitter Clock	114 (DB)
16	SRD	DCE	Sec Received Data	119 (SBB)
17	RC	DCE	Receiver Clock	115 (DD)
18				
	LL	DTE	Local Loopback	141 (LL)
19	SRTS	DTE	See Request To Send	120 (SCA)
20*	DTR	DTE	Data Terminal Ready	108/2 (CD)
21*	SQ	DCE	Signal Quality Detect	110 (CG)
22	RI	DCE	Ring Indicator	125 (CE)
23		DTE	Data Rate Selector	111 (CH)
			Data Rate Selector	112 (CI)
24	ETC	DTE	Ext Transmitter Clock	113 (DA)
25	TM	DCE	Test Mode	142 (TM)

Table 2-4. LED Status Indicators

LED STATUS INDICATOR	COLOR	SIGNAL DEFINITION
A	Red	DTE-A
B	Green	DTE-B
TD	Green	Transmitted Data
RD	Green	Received Data
DCD	Green	Data Carrier Detect
SQ	Green	Signal Quality Detect
RTS	Red	Request To Send
CTS	Red	Clear To Send
DSR	Red	Data Set Ready
DTR	Red	Data Terminal Ready
ALM	Yellow	Alarm On

Table 2-5. Alarm Time Delay Settings

ARC LENGTH	TIME DELAY 50 HZ AND 60 HZ ENVIRONMENT
γ	1 µsec
Shortest	64 msec
	256 msec
	0.51 sec
	1.02 sec
	8.19 sec
	32.75 sec
Longest	65.5 sec

3.3 Patch Module with A/B Switching and In-Line Patch Access (PSM-02)

This PS module operates similarly to the PSM-01 by providing patching, switching, and switch status indication, except it does not contain LED status indicators and alarm circuitry. A detailed circuit diagram of this module is shown in Figure 2-7.

4 A/B SWITCHING MODULE (PSM-03)

This module provides A/B switching only. A simplified circuit diagram of this module is shown in Figure 2-8.

The A/B switch activates the A/B relays. The A/B relays complete the channel between the DCE and either DTE-A or DTE-B. The relays also switch in the interlock jumper. Interlocking from the control module protects the user from accidentally switching common backup equipment onto two or more different data lines. The three classes of interlock groups available are:

1. Global Interlock: Groups 1 and 2 are global and may be extended to all chassis in a system, using a 20-pin interchassis interlock cable. With this grouping, all modules having a jumper placed on group 1 make up one group, and all modules with a jumper on group 2 make up the other group. Interchassis interlock cables must be installed between chassis. Each module interlock group may have no more than one jumper installed at one time.
2. Horizontal Interlock: Groups 3 and 4 are horizontal and they include only modules in the individual chassis. With this grouping, all modules having a jumper placed on group 3 make up one group and all modules with a jumper on group 4 make up the other group. These groupings do not extend out of the chassis and are not affected by the interchassis interlock cable. Each module interlock group jumper block may have no more than one jumper installed at a time.
3. Vertical Interlock: The vertical interlock jumper position is labeled V. Placing a jumper in this position interlocks all modules in the same slot location in other chassis having a jumper installed on the came V position. Interchassis interlock cables must be installed between chassis. The interchassis interlock cable is a 20 position ribbon cable (4WC-03) with a 20-pin connector for each chassis. Each module interlock group jumper block may have no more than one jumper installed at a time.

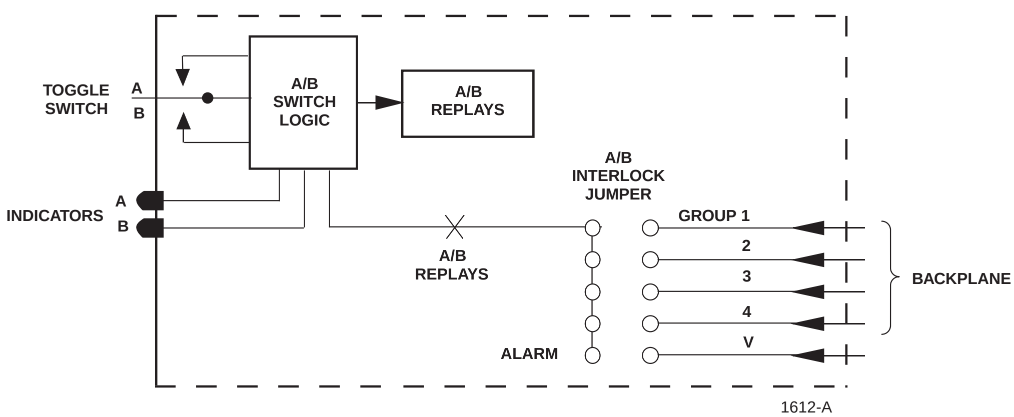

Figure 2-7. Patch Module with A/B Switching Detailed Circuit Diagram

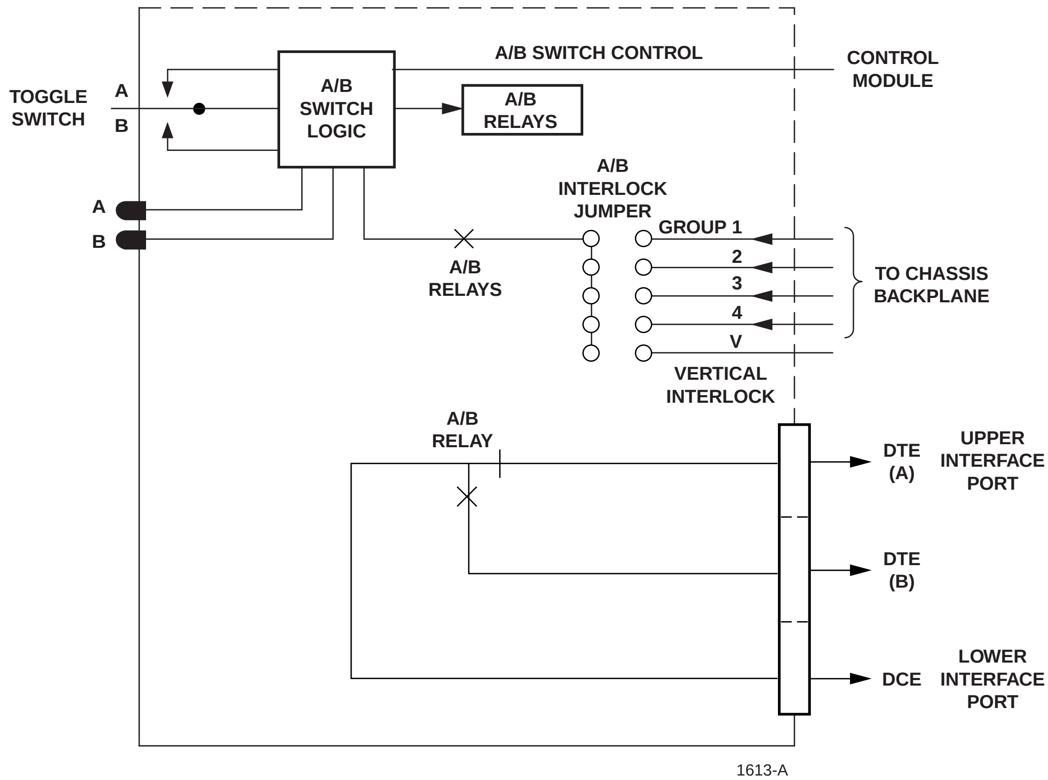

Figure 2-8. A/B Switching Module Simplified Circuit Diagram

5 LED/ALARM PATCH MODULE WITH A/B SWITCHING AND OFF-LINE ACCESS (PSM-04)

This module is the same as PSM-01 except that when it is in the A/B state, the off-line port provides direct test access to the off-line device (see Figure 2-2).

6 PATCH MODULE WITH A/B SWITCHING AND OFF-LINE ACCESS (PSM-05)

This module is the same as PSM-04 except it does not have LEDs or Alarm.

7 LED/ALARM PATCH INTERFACE (PSM-07)

This PS module provides interface patching together with status and alarm indications. A simplified circuit illustrating patching only is shown in Figure 2-9.

The COMPUTER patch cord jack connects directly to the chassis rear upper interface port. The MONITOR patch cord jack connects directly to the chassis rear lower interface port. The monitoring and alarm circuits of the PS module are shown in Figure 2-10. LEDs show the status of eight RS-232 leads. Each lead has a jumper connection to the alarm circuit control logic. The alarm is thus user selectable for any one of eight leads of the lower patch port. The EIA RS-232/ CCITT V.24 modem interface signal leads are shown in Table 2-3. The alarm circuit control logic supplies the alarm signal to the control module and an alarm indicator. This logic is also controlled by the RST (Reset) touch switch, toggle switch OFF (LED off, audible alarm off), ALM (LED and audible alarm on), LED (LED on, audible alarm off), and rotary switch DLY (alarm time delay setting). The alarm may be automatically reset if the automatic alarm reset jumper is in place. LED status indicators with their color and signal definition are shown in Table 2-4. Alarm delay settings are shown in Table 2-5.

7.1 Patch Interface (PSM-08)

This PS module provides interface patching. A simplified circuit showing patching is shown in Figure 2-9.

The COMPUTER patch cord jack connects directly to the chassis rear upper interface port. The MONITOR patch cord jack connects directly to the chassis rear lower interface port.

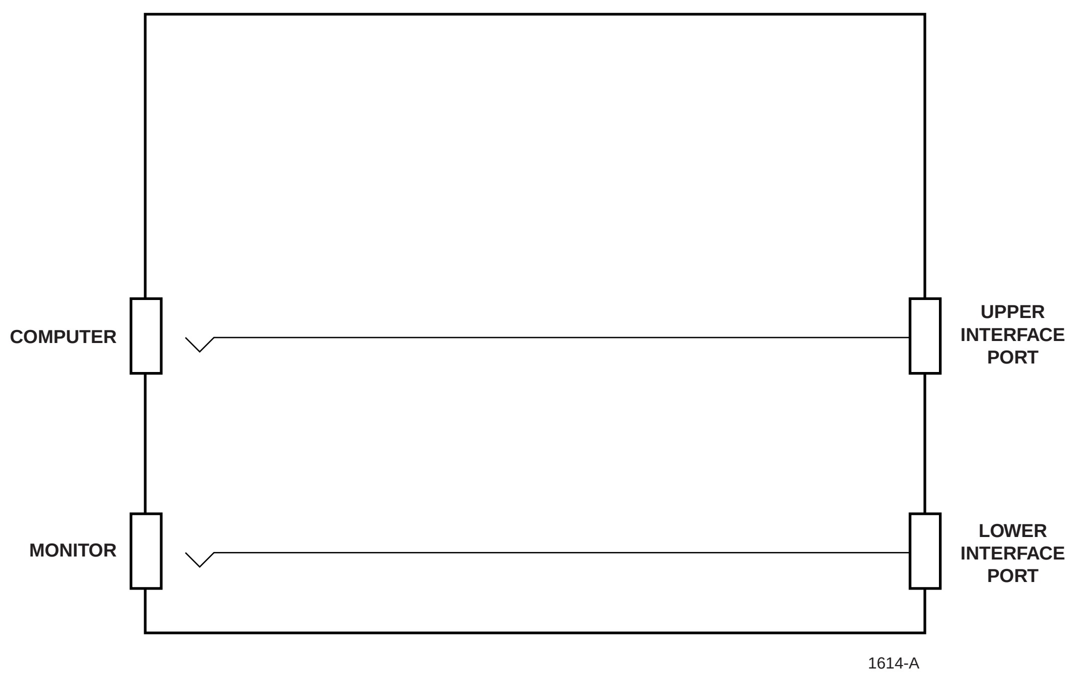

Figure 2-9. Patch Interface Simplified Circuit Diagram

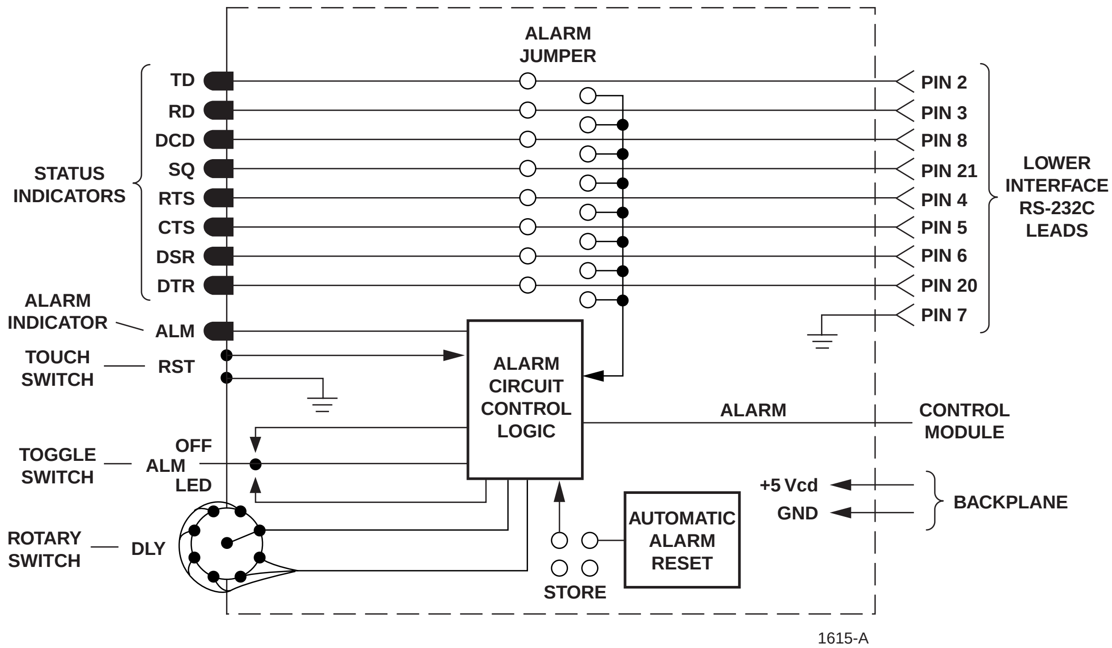

Figure 2-10. LED/Alarm Patch Interface Detailed Circuit Diagram

8 TEST MODULE (PSM-12)

Test Module PSM-12 provides the user with RS-232/V.24 interface capabilities, status indicators for eight (8) leads and alarm conditions. A simplified block diagram illustrating the test module connections is shown in Figure 2-11. Two female RS-232/V.24 TEST ports, located on the rear of the test module, are available for connecting the test equipment. Another female RS-232/V.24 port and a patch jack are located on the module front panel. All four connectors are hardwired in parallel.

The eight RS-232/V.24 circuit leads having LED indicators are: TD; RD; DCD; SQ; RTS; CTS; DSR; and DTR. When a monitored circuit lead is active (signal present), the associated LED indicator turns on (only while the signal is present). The colors and signal definitions for the applicable LED status indicators are detailed in Table 2-4.

An adjustable alarm circuit with associated LED (ALM), is provided to inform the user when a preselected alarm condition exists on one of the monitored leads. Each monitored lead has a jumper connection to the alarm circuit control logic. The alarm is user selectable for any one of the eight leads. The RS-232/V.24 interface signal leads are defined in Table 2-3. The alarm circuit control logic supplies the alarm signal to the control unit and an alarm indicator.

Note: Except for the A/B switching circuits, the circuit diagram shown in Figure 2-6 is applicable to PSM-12.

This logic is also controlled by the RST (Reset) touch switch, toggle switch OFF (LED off, audible alarm off), ALM (LED and audible alarm on), LED (LED on, audible alarm off), and rotary switch DLY (alarm time delay setting). The alarm may be automatically reset if the automatic alarm reset jumper is in place. Alarm delay settings are shown in Table 2-5. After an alarm condition occurs, the operator may reset the circuit by placing a finger on the RST (touch) switch contacts.

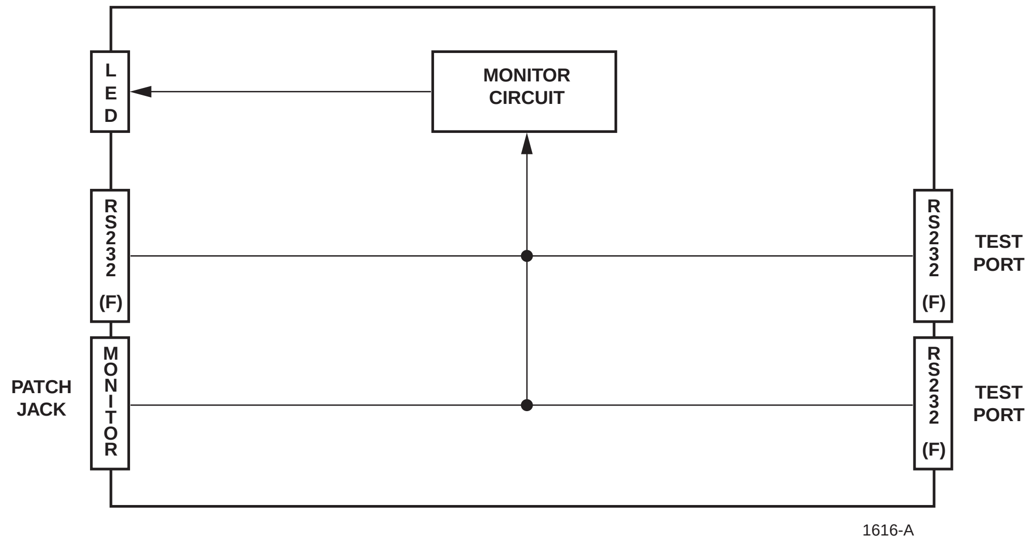

Figure 2-11. PSM-12 Test Module with LED Monitoring

9 TEST MODULE (PSM 13)

Test Module PSM-13 provides the user with the same RS-232/V.24 interface capabilities as Test Module PSM-12, except it does not contain status and alarm monitoring. A simplified block diagram illustrating the test module connections is shown in Figure 2-12.

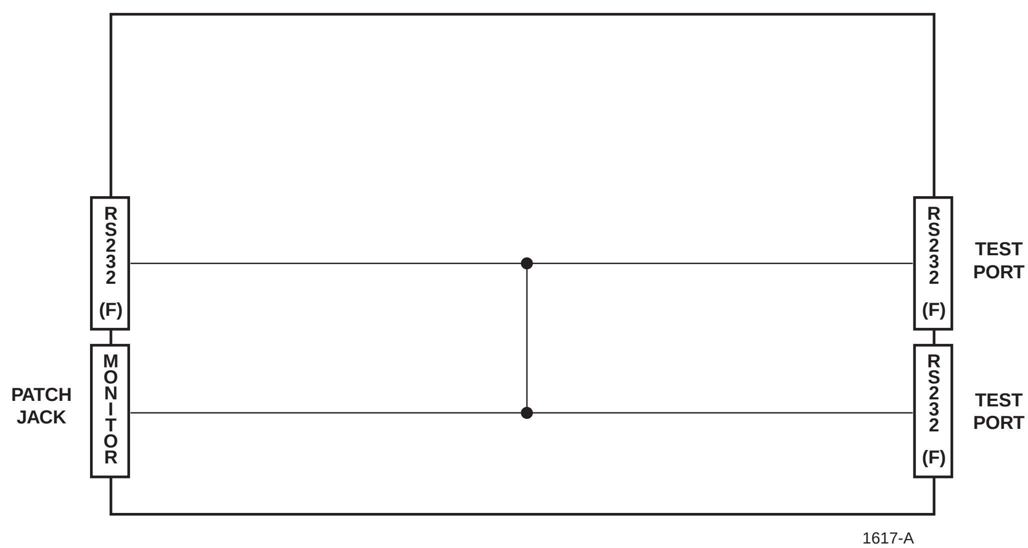

Figure 2-12. PSM-13 Test Module without LED Monitoring

10 PS RS-422/RS-232 INTERFACE CONVERTER MODULE (PSR-06)

The PatchSwitch module converts signals to provide RS-422/RS-232 compatibility for remotely controlled PatchSwitch equipment, see Figure 2-13. Mounted in slot position 17 of the PatchSwitch chassis, the Data Converter Module interfaces with the ADC Remote Control Unit, CRT terminal, or computer directly, or indirectly through modems and telephone lines. The module is a printed circuit board assembly with components, a front panel with four LED status indicators and a rear 96-pin DIN connector. There is one eight-position programming plug provided on the circuit board to assign the Interface Converter module as a DTE or DCE. This is done by placing the eight position programming plug into one of two DIP Sockets labeled DTE or DCE. There is also a two-position Berg Post to inactivate interface when Data Set Ready (DSR) is not asserted (DTE mode only). A simple block diagram illustrating the Data Converter connections is shown in Figure 2-14. Table 2-6 lists LED status indicators.

The functions of the Data Converter status indicators (LEDs are as follows):

RSP (Respond) flashes when data is being transmitted from the control module.

CMD (Command) flashes when data is being received by the control module.

SEL (Select) turns on when any attached PatchSwitch chassis has been addressed.

CTL (Control) turns on when a control device is on-line and ready (RTS or CTS signal).

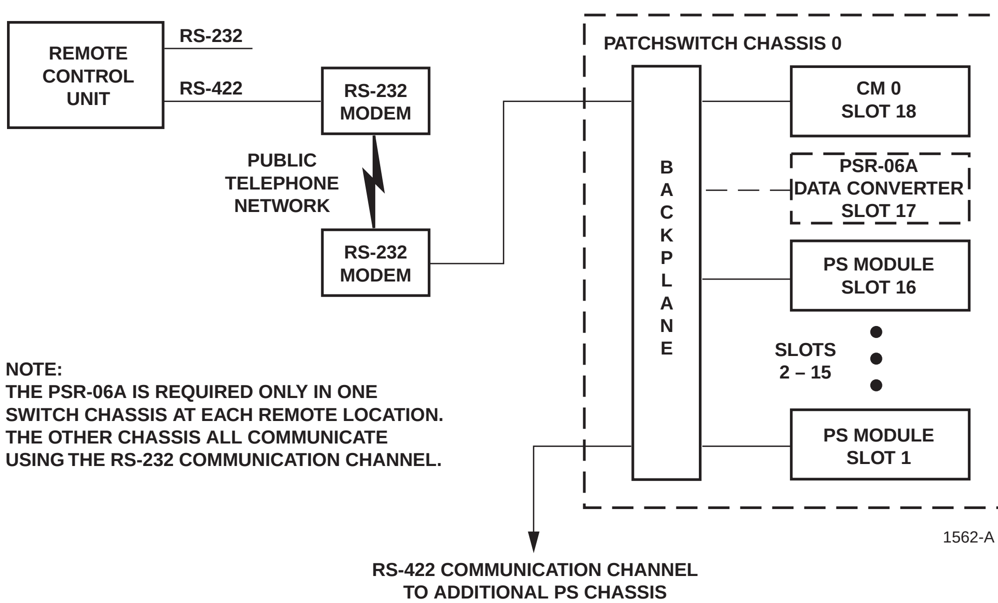

Figure 2-13. RCU to Remote PatchSwitch Chassis

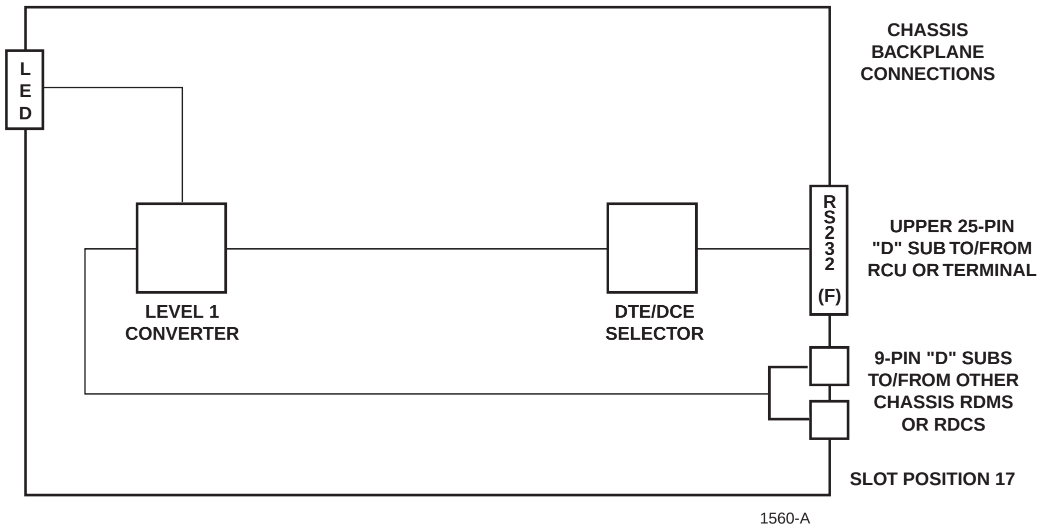

Figure 2-14. PSR-06 Interface Converter

11 PS CHASSIS POWER

A power supply unit is used with the PS Chassis. The PSW-000001 or PSW-000003 is used when input power is 90 to 240 VAC. The block diagram of the power supply is shown in Figure 2-15.

Table 2-6. Converter Module LED Status Indicators

STATUS INDICATOR	COLOR	SIGNAL DEFINITION	
		DCE	DTE
CMD	Green	TD	RD
RSP	Green	RD	TD
SEL	Red	CTS	RTS
CTL	Red	RTS	CTS

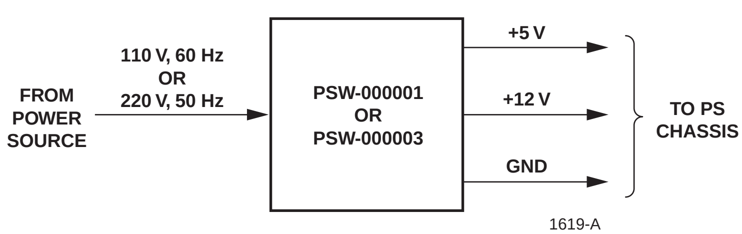

Figure 2-15. PS Chassis Power Supply Block Diagram

SECTION 3: PATCHSWITCH V.35

Content Page

1 PRODUCT OFFERING

The ADC V.35 PatchSwitch makes available four modules, four conversion boards and the necessary conversion patchcords for use with the 34-pin “V.35 Interface” data communications hardware.

The units are designed to be compatible with the RDC-01, RDC-02, PSC-01, and PSC-02 standard PatchSwitch chassis. The V.35 modules utilize grey front panels so they can be mixed with other interfaces and still be identified a V.35 circuits. The modules provide monitor and patch access in the Serial Binary Data Interchange (SBDI) portion of data communications circuit. Some modules also provide local and remote alarming as well as signal status indication. A more detailed description of each module is given in Table 3-1. The SBDI is typically found between the MODEM (DCE) and the TERMINAL/COMPUTER (DTE). A single circuit requires one module and one conversion board which connects between DTE-A or DTE-B and DCE. Switching takes place between DTE-A and DTE-B to connect to DCE. As an alternative to the V.35 conversion boards, V.35 cables using DB-25 connectors can be used to attach easily to the RDC-01/PSC-01 and RDC-02/PSC-02 PatchSwitch chassis.

Table 3-1. Product Description

PSM-16	PatchSwitch Module provides monitor, patch access and A/B Switching for DTE-A or DTE-B and DCE plus V.35 LED signal indication and circuit loss alarming.
PSM-17	PatchSwitch Module provides monitor, patch access and A/B Switching for DTE-A or DTE-B and DCE.
PSM-18	Interface Module provides patch access for test and/or line monitor equipment, plus LED signal indication and circuit loss alarming.
PSM-19	Interface Module provides patch access for test, and/or line monitor equipment.
FFM-01	PatchSwitch Conversion Board with female/female/male V.35 connectors and three male DB-25 connectors. Intended for use with the RDC-01/PSC-01 PatchSwitch chassis.
FFM-02	PatchSwitch Conversion Board with female/female/male V.35 connectors and male/ male/female DB-25 connectors. Intended use on the RDC-02/PSC-02 PatchSwitch chassis.
FF-01	PatchSwitch Conversion board with female/female V.35 connectors and male/male DB-25 connectors. Intended for use with RDC-01/PSC-01 and RDC-02/PSC-02 PatchSwitch chassis to accommodate PSM-18 or PSM-19 Patch Interface Modules.
FF-02	PatchSwitch Conversion board with female/male V.35 connectors and male/female DB-25 connectors. Intended for use with RDC-02/PSC-02 PatchSwitch chassis to accommodate PSM-18 or PSM-19 Patch Interface Modules.

2 APPLICATION WITH EXISTING UNITS

The V.35 PatchSwitch modules can be identified by their gray color. A conversion board must be installed onto the chassis, as shown in Figure 3-1 and Figure 3-2, before the V.35 module assembly is placed into service. If the conversion boards are not practical, user cables can be manufactured by local sources to terminate the standard V.35 interface into a DB-25 connector which can then be connected directly to the RDC-01/PSC-01 or RDC-02/PSC-02 chassis. Standard pin arrangements for the V.35 interface to the DB-25 connector can be found in Table 3-2. As defined further in this guide, optional leads are available on the conversion board to allow for any six of the normally unused leads on V.35 to be passed through the module. This option allows the user to configure to his specific needs.

Once the V.35 module is in service, it's use is the same as a regular PatchSwitch module. Test equipment such as a data line monitor can be connected to the V.35 patch Interface modules or the LED/Alarm options on the PSM-18 can be used as diagnostic functions with the PSM-17 using patch cords from one other module to the other. The DTE-A/DTE-B ports on the PSM-16 and PSM-17 can be used to provide bridge monitor on active circuits or patching into the "C" port can split the circuit and isolate towards the DCE leaving the "A" and "B" ports to isolate towards DTE-A and DTE-B respectively. The PSM-18 and PSM-19 interface modules can be used to attach to test equipment, patch in stand-by spare equipment, to be used as trunking jacks, or in the case of the PSM-18 LED/ALARM unit it can be used a diagnostic unit with the PSM-17.

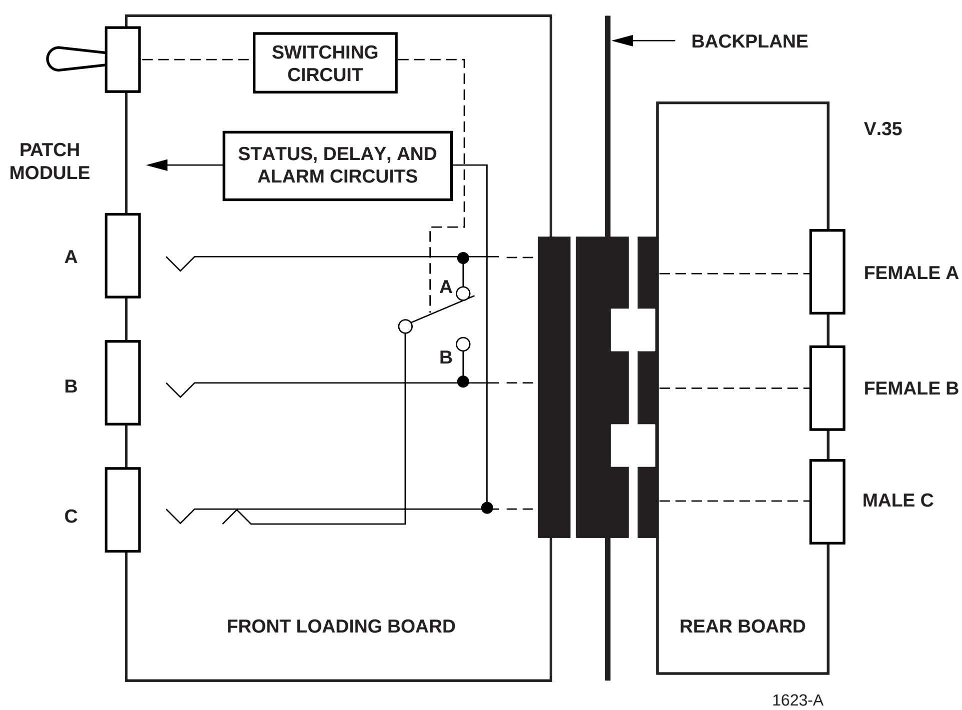

Figure 3-1. Switch Module and Conversion Board

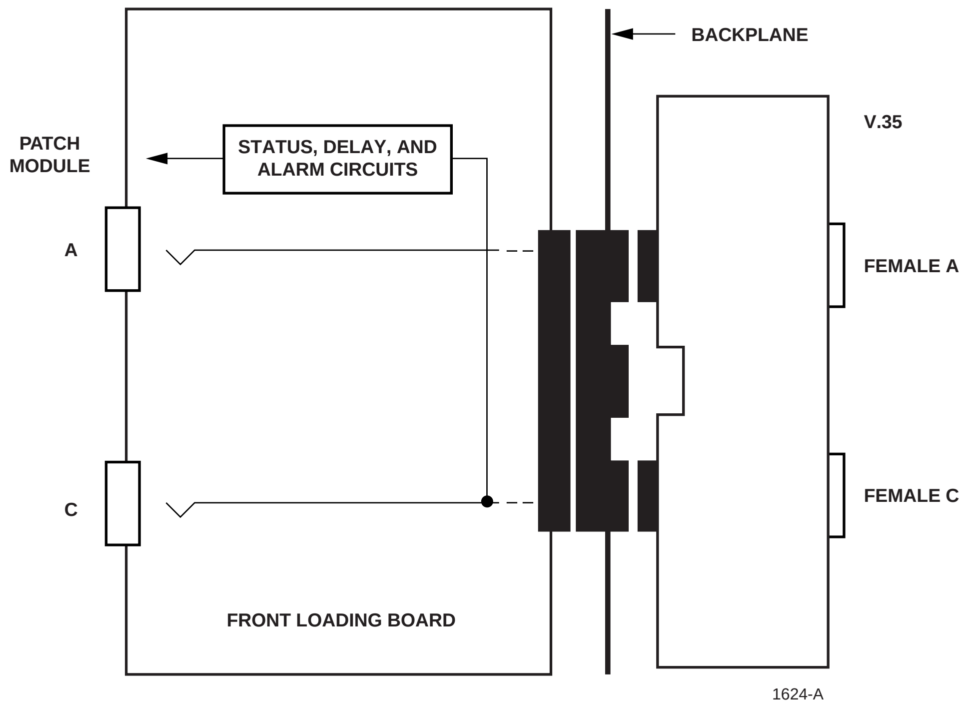

Figure 3-2. V.35 Interface Module and Conversion Board

Table 3-2. Normal Pin Assignments

V.35 PIN	NAME	ORIGIN	SIGNAL DESCRIPTION	DB-25 CONNECTOR PIN
A	FG		Frame Ground	1
B	SG		Signal Ground	7
C	RTS	DTE	Request to Send	4
D	CTS	DCE	Clear to Send	5
E	DSR	DCE	Data Set Ready	6
F	DCD	DCE	Data CXR Detect	8
H	DTR	DTE	Data Term Ready	20
J	RI	DCE	Ring Indicator	22
P	TD (+)	DTE	Trans Data (+)	2
S	TD (–)	DTE	Trans Data (–)	14
R	RD (+)	DCE	Rec Data (+)	3
T	RD (–)	DCE	Rec Data (–)	19
U	TCE (+)	EXT	Trans Clck Ext (+)	24
W	TCE (–)	EXT	Trans Clck Ext (–)	23

Table 3-2. Normal Pin Assignments, continued

V.35 PIN	NAME	ORIGIN	SIGNAL DESCRIPTION	DB-25 CONNECTOR PIN
V	RC (+)	DCE	Rec Clck (+)	17
X	RC (–)	DCE	Rec Clck (–)	18
Y	TC (+)	DCE	Trans Clck (+)	15
AA	TC (–)	DCE	Trans Clck (–)	16
MM	BSY	DCE	Busy Signal	25
K, L, M, N, Z, BB, CC, DD, EE, FF, HH, JJ, KK, LL, NN			Unassigned Pins	

3 FUNCTION SELECTION-MODULES

Several optional items shown in Table 3-3 should be considered before any PSM-16 or PSM-18 modules are placed into service. Factory settings are noted, refer to Figure 3-3 table for item locations. If factory settings are acceptable, no action is required.

Table 3-3. Optional Items on the Module

ITEM	DESCRIPTION	FUNCTION	
A	Trans Clk Source (Factory Setting)	DTE W,U	DCE AA, Y X
B	Alarm Sig Source (Factory Setting)	TD RD RTS CTS RC DTR DCD TC	
C	Alarm Reset Polarity (Factory Setting)	ALM+	ALM X
D	Alarm Reset (Factory Setting)	AUTO NOT-LCHD	MANUAL (LCHD) X
E	Alarm Delay (Factory Setting)	NO *SW pos 8 7 6 5 4 3 2 1 X	YES

* This screwdriver adjustment is made at the rotary switch on the face of the module near the bottom. Note the length of the lines around the switch, the longer the line, the greater the time delay. Switch position 8 is straight up.

Sw Pos	TD
8	None
7	62.5 msec
6	250 msec
5	500 msec
4	1.0 sec
3	8.0 sec
2	32.0 sec
1	64.0 sec

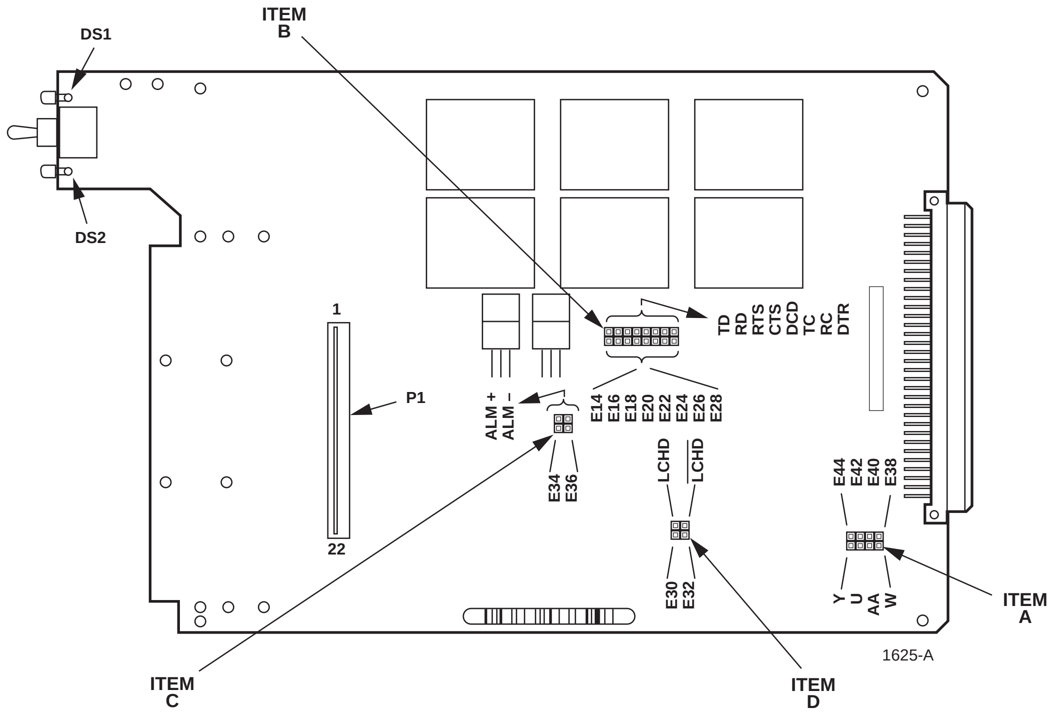

Figure 3-3. PSM-16 and PSM-17 Module PC Board (Component Side)

4 FUNCTIONAL SELECTION—CONVERSION BOARD

The item found in Table 3-4 is associated with the conversion board. Refer to Figure 3-4 or Figure 3-5 for item locations. The option available on the conversion board allows the user the ability to manage the V.35 lead set. This option, as noted in Table 3-5, allows the user to custom configure the leads patched in each of his V.35 modules for his specific needs. Normal Pin Assignments are shown in Table 3-6.

Table 3-4. Optional Item on the Conversion Board

1. Are any of the normally unassigned leads required by this circuit? (See Table 3-5)	
NO (Factory Set)	YES See note on Table 3-5

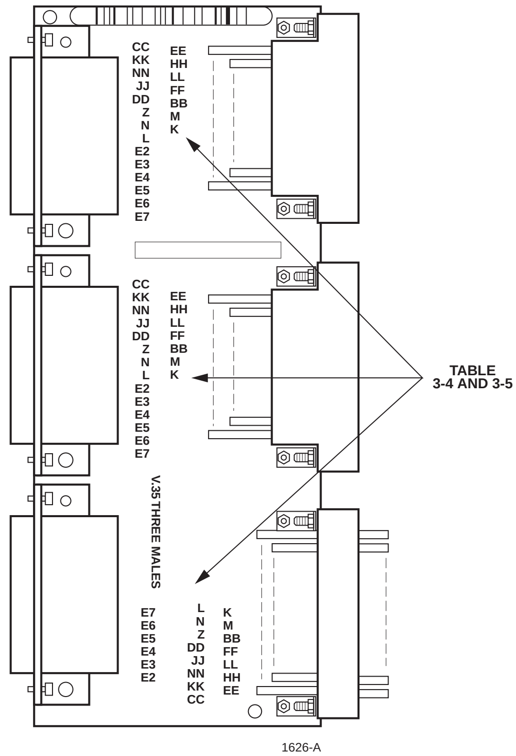

Figure 3-4. FFM-01 and FFM-02 Conversion Board

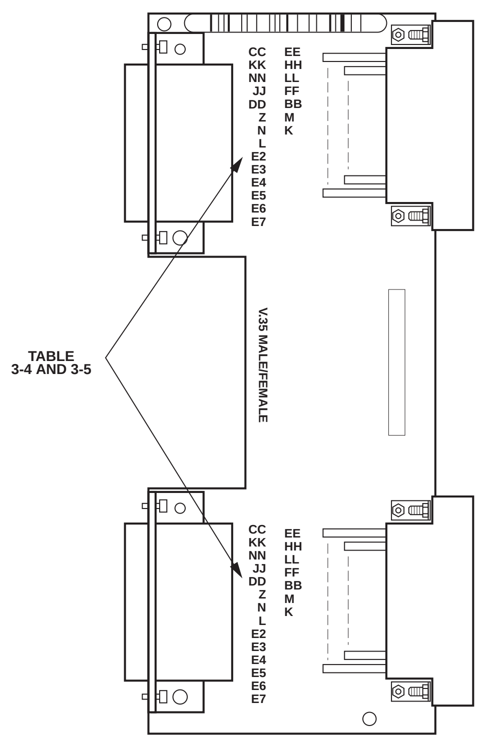

Figure 3-5. FF-01 and FF-02 Conversion MRodules

Table 3-5. Connections of Unassigned Pins on Subboard

	o---K
	o---L
	o---M
	o---N
oE2	o---Z
oE3	o---BB
oE4	o---CC
oE5	o---DD
oE6	o---EE
oE7	o---FF
	o---HH
	o---JJ
	o---KK
	o---LL
	o---NN

The Pin pattern and identification is as noted above for the fifteen (15) leads unused from the V.35 connector and the six (6) leads unused through the patching function. Any one of the fifteen leads to a maximum of six may be routed through the patch mechanism by means of straps if the user desires to bring more than the 19 lead V.35 interface through the patch mechanism. The procedure to follow to add a lead through the patch mechanism is simple. Assume you desire to bring lead EE through the patch mechanism on a DTE-A, DTE-B, and DCE module. Simply add a strap from E2 to EE on each of the three connector units on the FFM-01 or FFM-02 Subboard and lead EE is now routed through the patch mechanism and also switched from A to B if that action occurs. The procedure for the interface modules is the same. A strap added from E2 to EE on the top port will cause EE to appear at the top port only. If it is to appear also at the bottom port the additional strap must also be added there.

Table 3-6. Normal Pin Assignments

PIN	NAME	ORIGIN	SIGNAL DESCR	PIN	NAME	ORIGIN	SIGNAL DESCR
A	FG		Frame Ground	T	RD (–)	DCE	Rec Data (–)
B	SG		Signal Ground	U	TCE (+)	EXT	Trans Clck Ext (+)
C	RTS	DTE	Request to Send	W	TCE (–)	EXT	Trans Clck Ext (–)
D	CTS	DCE	Clear to Send	X	RC (–)	DCE	Rec Clck (–)
E	DSR	DCE	Data Set Ready	V	RC (+)	DCE	Rec Clck (+)
F	DCD	DCE	Data CXR Detect	Y	TC (+)	DCE	Trans Clck (+)
H	DTR	DTE	Data Term Ready	AA	TC (–)	DCE	Trans Clck (D) (–)
J	RI	DCE	Ring Indicator	MM	BSY	DCE	Busy Signal
P	TD (+)	DTE	Trans Data (+)	K, L, M, N, Z, BB, CC, DD, EE, FF, HH, JJ, KK, LL, NN			Unassigned Pins
S	TD (–)	DTE	Trans Data (–)				
R	RD (+)	DCE	Rec Data (+)				

5 HARDWARE INSTALLATION

Remove power to the shelf by turning off the power supply or unplugging the power transformer connected to the chassis.

If proceeding with an upgrade of a current installation it may be necessary to remove any cable wrap, clamps or cord form any existing cable brackets to allow room for installation of the conversion boards. Be careful not to damage cables or connectors in the process.

Working at the back of the equipment bay, install an FFM-01 or FFM-02 conversion board, as appropriate, into a slot at the right-most vacant position of the chassis. Conversion boards can only be installed in positions 1 through 16. Proceed as follows. While facing the back of the chassis, hold the conversion board in a vertical position with the 34-pin connectors towards yourself and the 25-pin connectors away for you. Place the three 25-pin connectors into the three 25-pin mating connectors on the chassis and press firmly into place. Tighten the two mounting screws per connector to assure a good connection.

The FF-01 or FF-02 conversion board is meant to convert the 17th position of the RDC-01/PSC-01 or RDC-02/PSC-02 PatchSwitch chassis to be used with the PSM-18 or PSM-19 interface modules. In addition, this module can also convert position 1 to 16 of the RDC-01/PSC-01 chassis to be used as interface module positions. If position 1-16 of a RDC-02/PSC-02 chassis must be converted to interface module positions, then the FF-02 must be used.

Bring the end of the DCE cable in from the side of the equipment rack and connect it to the bottom connector on the conversion board. Form the cable neatly away from the board along an equipment rack cable bracket towards the equipment rack upright. Be sure that the conversion board does not have any side pressure from the cable in any direction. Using cable straps or appropriate cord, fasten the cable to the cable bracket as applicable.

Bring the end of the “B” DTE cable in from the other side of the equipment rack and connect it to the middle connector on the conversion board. Form the cable neatly away from the connector sub-board along an equipment rack cable bracket towards the equipment rack upright. Be sure that the conversion board does not have any side pressure from the cable in any direction. Using cable straps or appropriate cord fasten the cable to the cable bracket. Bring the end of the “A” DTE cable in from the the side of the equipment rack and connect it to the top connector on the conversion board. Form the cable neatly away from the conversion board along an equipment rack cable support bracket towards the equipment rack upright. Install additional conversion boards using the directions above. Work from the right side of the chassis towards the left (as seen from the rear). This gives room to the left in which to work and makes for a much neater installation.

Carefully install the PatchSwitch V.35 module into the chassis making sure that the 96-pin DIN connector on the front of the unit engages the connector in the chassis. Tighten the hold-down screws on the front of the module

Plug the power transformer removed earlier back into its socket or turn on the power supply to re-establish power for the units.

6 RECOMMENDED MATING CONNECTOR PARTS

DESCRIPTION	VENDOR	PART NUMBER
Connector V.35 (Female)	WINCHESTER POSITRONICS	MRAC MS 34S VMCT-34F-000000-538-Z
Contacts (Female)	WINCHESTER POSITRONICS	100-51024S FC 124N2
Hood	WINCHESTER POSITRONICS	MRE34JTDH G34-00000-40
Connector V.35 (Male)	AMP INC	201357-1
Contacts (Male)	AMP INC	66703-2

Note: The hold down screws on the cable plugs for the ADC V.35 Connector Subboard are a standard NSC 6/32 thread. Some plugs are different. They look similar but have different pin assignments. Make sure your plugs are compatible before connecting them. Replacement connectors can be fashioned using the above parts list. This list does not imply that only these parts will fit. Compatible parts may be available from other vendors.

SECTION 4: PATCHSWITCH X.21

Content Page

1 GENERAL

The ADC PatchSwitch X.21 consists of several modules and backplane adapters that allow you to conveniently manage your X.21 networks. These modules and adapters are designed to be compatible with the standard PatchSwitch chassis RDC-01, RDC-02, PSC-01, and PSC-02. They can be mounted in the same chassis with the PatchSwitch RS-232 modules. Once the X.21 module is in place its use is similar to the standard PatchSwitch module. Each module that requires power is powered by the chassis power supply. Portions of the Patch Modules are covered by U.S. Pat. No. 4,363,941 and corresponding foreign Letters Patent.

2 DESCRIPTION

The ADC PatchSwitch X.21 modules provide monitor and patch access to X.21 leads. Some modules also provide local and remote alarming, testing, or status indicators.

2.1 PSM-812001 X.21 LED/Alarm Patch Module with A/B Switching and Off-Line Patch Access

This module provides monitoring and access to 15 active X.21 leads, A/B Switching, LED signal status indication, and call request and termination time-out alarming. A block diagram representing the PSM-812001 Module is shown in Figure 4-1.

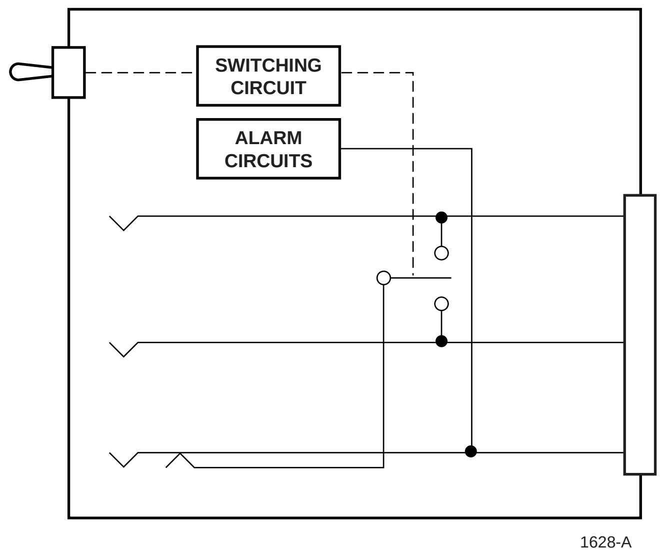

Figure 4-1. PSM-812001 Module Block Diagram

2.2 PSM-813001 X.21 PatchSwitch Module with A/B Switching and Off-Line Patch Access

This module provides monitoring and access to 15 active X.21 leads and A/B/ Switching. A Block diagram representing the PSM-813001 module is shown in Figure 4-2.

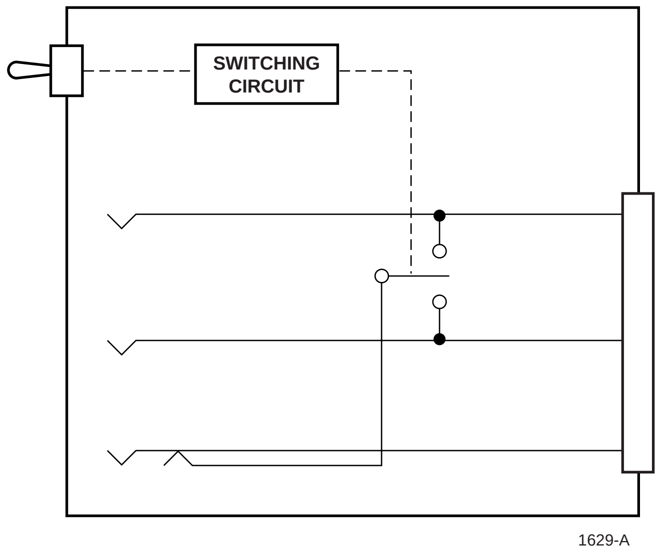

Figure 4-2. PSM-813001 Module Block Diagram

2.3 PSM-832001 X.21 LED/Alarm PatchSwitch Interface Module

This Module provides monitoring and access to 15 active X.21 leads, LED signal status indication, and call request and termination time-out alarming. A block diagram representing the PSM-832001 module is shown in Figure 4-3.

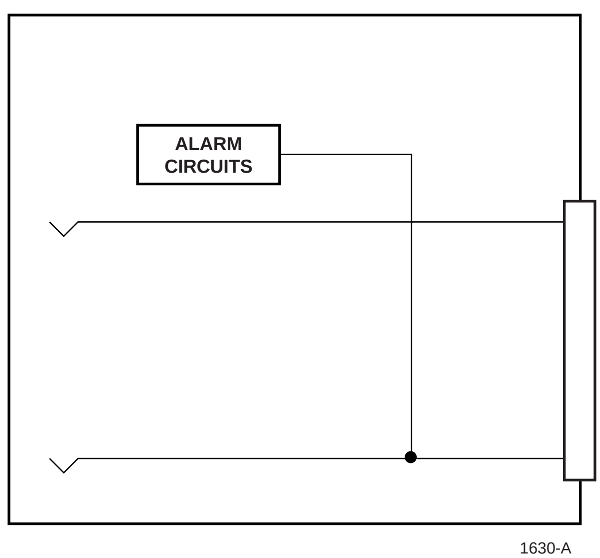

Figure 4-3. PSM-832001 Module Block Diagram

2.4 PSM-83301 X.21 PatchSwitch Module

This module provides monitoring and access to 15 active X.21 leads. A block diagram representing the PSM-833001 module is shown in Figure 4-4.

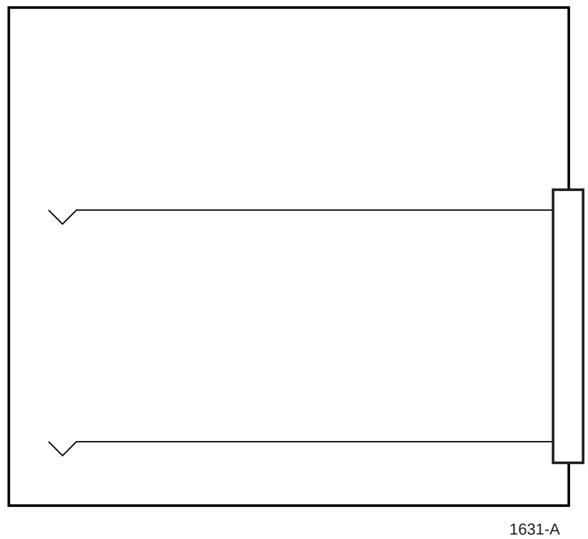

Figure 4-4. PSM-833001 Module Block Diagram

2.5 PSM-832002 X.21 LED/Alarm PatchSwitch Test/Status Module

This module provides monitoring and access to 15 active X.21 leads through a standard patch port. In parallel with this port there is a female 15-pin D-sub connector that may be connected to external equipment. LED signal status indication, call request and termination time-out alarming, and six quiescent state indicators are also provided on this module. A block diagram representing the PSM-832002 module is shown in Figure 4-5.

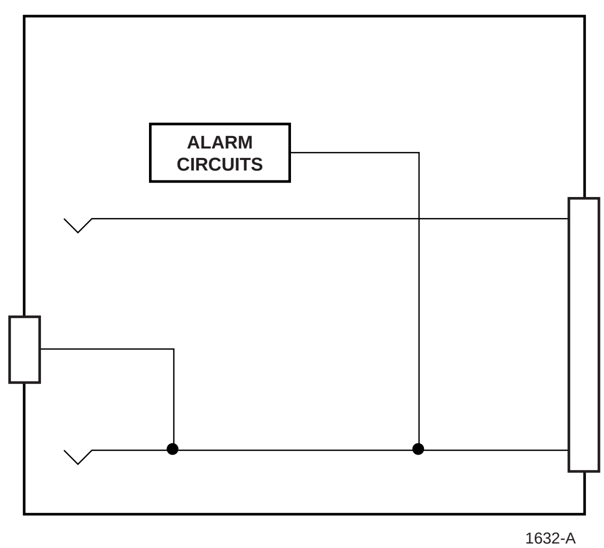

Figure 4-5. PSM-832002 Module Block Diagram

2.6 PSO-839001 Backplane Adapter Module

Three 15-pin D-sub connectors, located on the back of this backplane adapter provide a point of connection for customer cabling. The top two rear connectors are female and the bottom one is male. Three male 25 pin D-sub connectors on the front of the backplane adapter provide connections to the RDC-01/PSC-01 PatchSwitch chassis backplane.

2.7 PSO-836001 Backplane Adapter Module

Three 15 pin D-sub connectors, located on the back of this backplane adapter provide a point of connection for customer cabling. The top two rear connectors are female and the bottom one is male. Three 25 pin D-sub connectors on the front of the backplane adapter provide connections to the RDC-02/PSC-02 PatchSwitch chassis backplane. The top two front connectors are male and the bottom one is female.

2.8 PSO-839002 Backplane Adapter Module

This adapter is used with the Interface or Test/Status module only and is always installed in chassis slot 17. Two female 15-pin D-sub connectors, located on the back of this backplane adapter provide a point of connection for customer cabling. Two male 25 pin D-sub connectors on the front of the backplane adapter provide connections to slot 17 of any PatchSwitch chassis backplane.

3 FUNCTIONAL DESCRIPTION

3.1 A/B Switch Modules

All X.21 PatchSwitch modules with A/B switching are capable of switching either rear port A or rear port B to rear port C. This switching is accomplished using the front panel toggle switch in conjunction with an enable signal from the backplane. See Figure 4-6 for a block diagram showing the switching configuration.

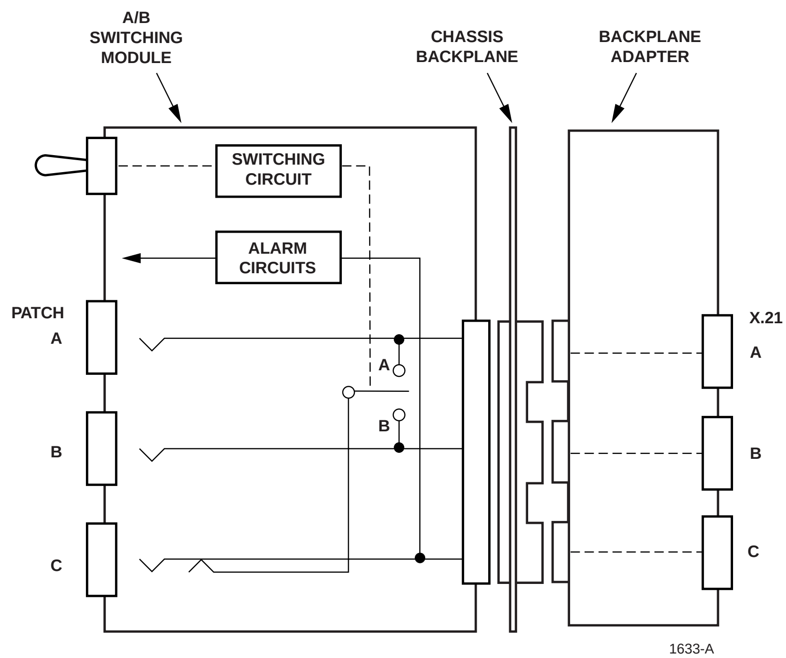

Figure 4-6. A/B Switching Block Diagram

3.2 Switch Module Interlocks

The A/B switch activates the A/B relays. The A/B relays complete the X.21 circuit between the DCE and either the DTE-A or DTE-B. The relays also switch in the interlock group. A and B status indicators show the DTE-A and DTE-B selection. Switch Interlocks prevent you from accidentally switching two modules to the same spare or equipment. The A/B interlock jumper Groups 1, 2, 3, and 4 allow for connection of each module to one of four different groups. The A/B interlock Group V allows each module on a chassis to be interlocked vertically with corresponding modules on any chassis connected with an interchassis interlock cable (catalog number 4WC-03).

3.3 Monitor, Patch, and Access Modules

These modules contain three front panel jacks for easy access to the X.21 data circuit, and rear connectors for attaching the module to the digital circuit. The rear connectors are provided to interface with the computers communications network. A portion of the rear connector is used to attach the X.21 circuit from the DTE (a computer or front end processor). The remainder of the rear connector is used to attach the circuit to the DCE (a modem).

In the normal mode (no patch cords inserted into the top or middle front jacks), the X.21 circuit has a through-path into and out of the Patch module. In the normal mode, the insertion of a patch cord connector into the top or middle front panel jack allows the entire circuit to be monitored with no interruption of the signals. In the patch mode, insertion of a patch cord connector into the bottom front panel jack breaks the circuit and permits monitoring of only the DCE portion of the data circuit.

3.4 Status Indication Modules

The six X.21 circuit leads having LED indicators are: T, C, R, I, S, and B. When a monitored circuit lead is active (signal present), the associated LED indicator turns on only while the signal is present. The colors and signal definitions for the applicable Led Status indicators shown in Table 4-1.

Table 4-1. Signal Status

ABBREVIATION	SIGNAL NAME/LEAD	LED COLOR	SIGNAL ORIGIN
T	Transmit	Green	DTE
C	Control	Green	DTE
R	Receive	Red	DCE
I	Indication	Red	DCE
S	Signal Element Timing	Red	DCE
B	Byte Timing	Red	DCE

3.5 Alarm Modules

Two time-out alarm functions are provided.

Alarm A Monitors the time between the raising of C lead and the raising of the I lead during the call request phase. If this value is greater than the user selected interval, the A alarm LED and/or audible alarm is activated.

Alarm B Monitors the time between the dropping of the I lead and the dropping of the C lead or the dropping of the C lead and the dropping of the I lead, during the call clear phase. If this value is greater than the user selected interval, the B alarm LED and/or audible alarm is activated.

The alarm is indicated by the amber LED and/or an audible alarm located in the chassis. Both alarms have independent variable delays and can be turned off.

The three position toggle switch located on the front panel allows the following choices:

ALM Visual and Audible alarms on.

OFF Visual and Audible alarms off.

LED Visual alarm only.

3.6 Alarm Reset

To reset the alarm on the PSM-832002 push the switch marked RST. To reset alarm on all other alarm modules touch the the pads marked RST. If alarm condition has not cleared, the alarm will time-out, and alarm will be tripped again.

3.7 Alarm Time Delay

The PSM-832002 Test/Status module contains two eight position rotary switches on the front panel. One for the A alarm delay and one for the B alarm delay. All other modules contain one eight position rotary switch on the front panel. This switch is used to set the B alarm delay. The A alarm time delay is set using a 16 position rotary switch located on the PC board.

Time delay values are fixed. The switch positions are time values ranging from none to 105.9 sec. nominal. Time delay settings (8 position switch) are denoted on the front panel by varying length arcs around the rotary switch, the longer the arc — the greater the time delay. Time delay settings (16 position switch) are denoted on the switch by numbers and letters. Time delay values are listed in Table 4-2 and Table 4-3.

Table 4-2. A Alarm Time Delay Settings

SWITCH POSITION	TIME DELAY	
	PSM-832002 MODULE	OTHER ALARM MODULES
0	None	None
1	0.9 sec	1.9 sec
2	1.9 sec	7.9 sec
3	3.9 sec	9.9 sec
4	7.9 sec	31.9 sec
5	15.9 sec	33.9 sec
6	31.9 sec	39.9 sec
7	63.9 sec	41.9 sec
8	—	63.9 sec
9	—	65.9 sec
A	—	71.9 sec
B	—	73.9 sec
C	—	95.9 sec
D	—	97.9 sec
E	—	103.9 sec
F	—	105.9 sec

Table 4-3. B Alarm Time Delay Settings

ARC LENGTH	SWITCH POSITION	TIME DELAY
V	0	None
Shortest	1	55 msec
	2	117 msec
	3	242 msec
	4	492 msec
	5	992 msec
	6	1.9 sec
Longest	7	3.9 sec

3.8 B Alarm Enable/Disable

The alarm can be disabled by moving the jumper labeled ALMB/ALMB on the module board. The alarm is enabled when the jumper is in the ALMB position. The alarm is disabled when the jumper is in the ALMB position.

3.9 PSM-832002 Module Quiescent State Indicators

Six LEDs located on the front panel indicate the presence of the quiescent states found in Table 4-4. When the module is powered up and not connected to a X.21 circuit LED number one will be on indicating a state one condition. This is like an idle state on a live X.21 circuit.

Table 4-4. Quiescent State Indicators

STATE	DTE	DCE	LED COLOR
1	Ready	Ready	Green
14	Controlled Not Ready	Ready	Red
18	Ready	Not Ready	Red
22	Uncontrolled Not Ready	Not Ready	Red
23	Controlled Not Ready	Not Ready	Red
24	Uncontrolled Not Ready	Ready	Red

4 POWER REQUIREMENTS

The PatchSwitch chassis requires a power supply (110 Vac/60 Hz, 220 Vac/50 Hz, or –48 Vdc input) to supply the modules with power. The power supply provides the correct dc output voltage and current for the PatchSwitch chassis.

5 SPECIFICATIONS

Module specification are shown in Table 4-5.

Table 4-5. Specifications

PARAMETER	SPECIFICATIONS	REMARKS
Dimensions		
H × W × D	6.95 × 0.94 × 9.82 inches	Install in RDC-01 or RDC-02 chassis
X.21 Modules	6.95 × 0.6 × 2.75 inches	Install in RDC-01 or RDC-02 chassis
Adapter Mofule		
Environmental		
Temperature		
Operating	+32° to 122° F (0° to 50° C)	
Storage	–32° to 158° F (–40° to 70° C)	
Relative humidity		
Operating	10 to 80%	No condensation
Storage	5 to 90%	No condensation
Power		
Power Supply	+5 volts dc	PSW-000003 (ac power source)
	+12 volts dc	
Current Supply	200.0 ma max.	

6 INSTALLATION

Remove power to the shelf by turning off the power supply or unplugging the power supply connected to the PatchSwitch chassis.

6.1 Interlock Jumper Installation

If an interlock option is desired for the system, the proper jumper must be connected in each A/B Switch Module before installation in the chassis. Each A/B switch module has five interlock positions. One jumper position for each of four interlock groups labeled 1 through 4 and one vertical interlock group labeled V. See Figure 4-7 for the location of the jumpers on the module.

Interlocking is used to protect the user from accidentally switching a common backup piece of equipment onto two or more different data lines. This is accomplished by allowing only the first module in that group to switch. The remaining modules remain in the “normal state” or the “A” position. Modules in the “B” position once switched to “A” will remain in the “A” position.

The three classes of interlock groups available are:

1. Global Interlock: Groups 1 and 2 are global and may be extended to all chassis in a system, using a 20-pin interchassis interlock cable. With this grouping, all modules having a jumper placed on group 1 make up one group, and all modules with a jumper on group 2 make up the other group. Interchassis interlock cables must be installed between chassis. Each module interlock group jumper block may have no more than one jumper installed at one time.
2. Horizontal Interlock: Groups 3 and 4 are horizontal and they include only modules in the individual chassis. With this grouping, all modules having a jumper placed on group 3 make up one group, and all modules with a jumper on group 4 make up the other group. These groupings do not extend out of the chassis and are not affected by the interchassis interlock cable. Each module interlock group jumper block may have no more than one jumper installed at a time.
3. Vertical Interlock: The vertical interlock jumper position is labeled V. Placing a jumper in this position interlocks all modules in the same slot location in other chassis having a jumper installed on the same V position. Interchassis interlock cables must be installed between chassis. The interchassis interlock cable is a 20 position ribbon cable (4WC-03) with a 20-pin connector for each chassis. Each module interlock group jumper block may have no more than one jumper installed at a time.

6.2 Alarm Jumper Installation

Determine B alarm Enable or Disable before installing module. Modules are shipped with the jumper strap placed in the ALMB position as shown in Figure 4-7. In this position the B Alarm is enabled. To disable the B Alarm move the jumper to $\overline{\text{ALMB}}$.

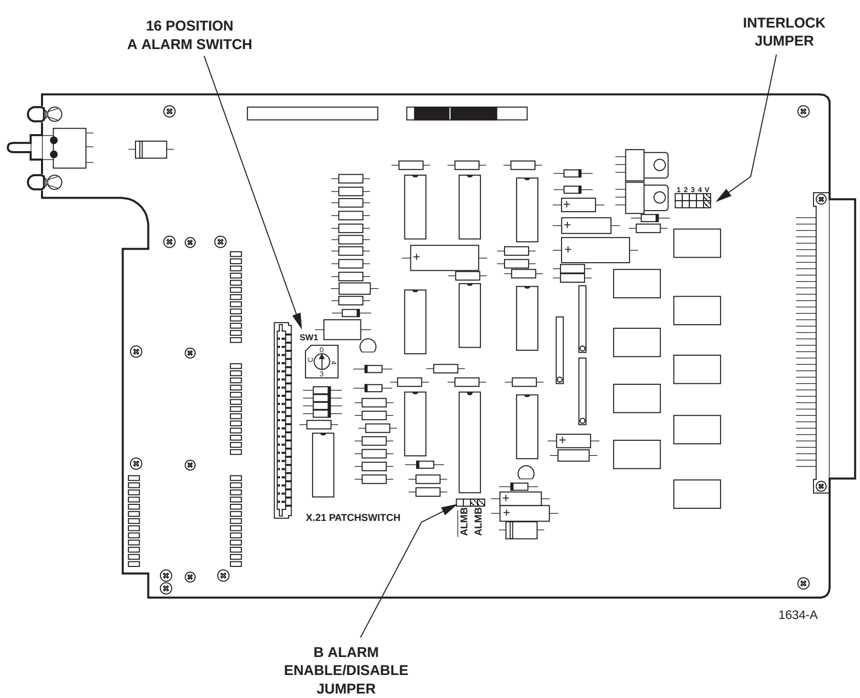

Figure 4-7. Jumper Strap and B Alarm Time Delay Setting Location

6.3 Alarm Time Delay Setting

Time delay values are fixed. The switch positions are time values ranging from none to 105.9 seconds nominal. The PSM-832002 Test/Status module contains two eight position rotary switches (A and B Alarm) on the front panel that can be set after the module is installed. All other modules contain one eight position rotary switch (B Alarm) on the front panel. This switch can be set after the module is installed. The A alarm time delay (call request) is set using a 16 position rotary switch located on the PC board.

Time delay settings (8 position switch) are denoted on the front panel by varying length arcs around the rotary switch, the longer the arc – the greater the time delay. Time delay settings (16 position switch) are denoted on the switch by numbers and letters. Set desired time delay before installing module in the chassis. Time delay values are listed in Table 4-2 and Table 4-3.

6.4 Adapter Installation

Working at the back of the chassis, install PSO-839001 or PSO-836001 adapters, as appropriate, into a slot at the right-most vacant position of the chassis. The PSO-839002 adapter is normally installed in position 17 behind the PSM-832002 Test Module. While facing the back of the chassis, hold the adapter in a vertical position with the 15-pin connectors towards yourself and the 25-pin connectors away from you. Place the three 25-pin connectors into the three 25-pin mating connectors on the chassis and press firmly into place. Using the screws provided, tighten the connector to assure a good connection.

6.5 Module Installation

PSM-832002 module is installed in the right most chassis slot when chassis is viewed from the front. If slot 17 is open install PSM-832002 module in this slot. The other modules can be installed in any of the other chassis slots.

Carefully install PatchSwitch X.21 modules into the chassis making sure connectors on the bottom edge of the module engage the slots on the mother board as appropriate. Using a #3 Phillips head screwdriver tighten hold down screws on the front of the modules.

6.6 Cable Connections

The next step is to attach the data communications network to the rear connectors.

The top two rear X.21 connectors are provided for the attachment of the DTE portion of the circuit. Bring the end of the “B” DTE cable in from one side of the equipment rack and connect it to the middle connector on the adapter. Bring the end of the “A” DTE cable in from one side of the equipment rack and connect it to the top connector on the adapter.

The bottom rear X.21 connector is provided for the attachment of the DCE portion of the circuit. Bring the end of the DCE cable in from the other side of the equipment rack and connect it to the bottom connector.

Form the cables neatly away from the modules along the back of the chassis towards the equipment rack upright. Use cable ties as necessary to secure cables in place.

Plug in the power supply or turn power on to establish power for the modules.

SECTION 5: SITE PREPARATION

Content	Page

1 GENERAL

This section contains the information necessary to prepare a facility for installing the PatchSwitch hardware.

2 SPACE REQUIREMENTS

All PatchSwitch chassis are normally installed into existing standard 19-inch racks (or in 23-inch racks with appropriate adapters). Each chassis occupies a rack space of 7 inches in height and 12 inches in depth.

Prior to installation, select the rack positions in the system where the chassis and other units of PatchSwitch equipment are to be located.

3 ENVIRONMENTAL CONSIDERATIONS

The allowable ambient temperature range for shipping or storage is –40° F to +158° F (–40° C to + 70° C). For operation, the allowable ambient temperature range is from +32° F to +122° F (0° C to +50° C). The relative humidity may vary from 10% to 80% in the range of +32° F to +122° F (0° C to +50° C) provided there is no condensation.

4 POWER REQUIREMENTS

Each PS chassis uses a power supply that requires a source of 110 Vac, 60Hz (or 220 Vac, 50 Hz) single phase commercial power. The PSW-000001 or PSW-000003 power supplies are stand-alone ac to dc converters with six-foot line power cords and six-foot chassis power cords. Convenience outlets must be within 12 feet of the chassis rear power connector.

SECTION 6: INSTALLATION

Content	Page

1 GENERAL

This section contains the information necessary to install the PatchSwitch equipment.

1.1 PatchSwitch Chassis Installation (For PatchSwitch V.35 Installation, see Section 3)

Warning: *To prevent electrical shock, never install PatchSwitch equipment in a wet location or during a lightning storm. When installing or modifying telephone lines, disconnect lines at the network interface before working with uninsulated lines or terminals.*

Carefully remove the PatchSwitch chassis from its shipping container and visually inspect the unit(s) for signs of damage.

Note: When PatchSwitch equipment is shipped from the factory, each component and all associated parts, hardware and accessories are properly packaged according to accepted practices for transporting via commercial common carrier. Evidence of actual or possible damage to the equipment, and/or missing parts, should immediately be reported to the commercial carrier or his agent and notify ADC Telecommunications, Inc.

The PatchSwitch equipment is normally shipped with the modules installed in the chassis. If the modules are not contained in the chassis location slots when the shipment is received, perform the PatchSwitch Modules Installation Procedure. When the chassis is received with the modules installed, perform the following procedure:

1. Mount the PS chassis in the selected rack space.
2. Secure the chassis to the rack with the appropriate standard hardware.

After each PS chassis is installed, perform the Chassis Power Supply Connection Procedure in this section of the manual.

1.2 PatchSwitch Module Installation Procedure

Modules may be installed before or after the chassis is installed in the rack. If the modules are to be installed after the chassis is installed, disconnect the power supply from the wall outlet before performing the following procedure.

⚠ **Warning:** *A potential shock hazard exists whenever making adjustments inside any electrical device. Use extreme caution when approaching these areas. Ensure that the power to the rack and chassis is off. To avoid personal injury and/or equipment damage, the power to the chassis must remain off until all installation and connection procedures are completed.*

1. Select the appropriate strapping options as determined by your application and described in Section 2, Section 3, and Section 4 of this manual.
2. Grasp the module by the front panel and insert it into the selected chassis position.
3. Slide the module into the guides until the unit is firmly seated.
4. Using a #3 Phillips-head screwdriver, secure the module to the chassis by tightening the two captive front panel screws.
5. Repeat the previous procedure for each module to be installed.

1.3 Blank Panel Installation

The blank panel is installed onto the chassis by positioning the blank panel over the empty chassis slot position and securing it to the chassis using the two captive front panel Phillips-head screws.

1.4 Chassis Power Supply Connection Procedure

Each PS chassis requires a separate power supply. The ac power supplies (PSW-000001 and PSW-000003) are equipped with six-foot line power cords and six-foot dc power cords.

The dc power cord contains five wires terminated with a female connector that plugs into a connector on the rear of the PS chassis.

The backplane connector and the dc power cord are “keyed” to prevent improper installation. See Figure 6-1 for power supply connector location.

Note: These steps must be performed as indicated (first a then b). Performing step b first will prevent the power supply from operating (no output voltage).

1. Connect the dc power supply cord female connector onto the chassis power supply male connector.
2. Connect power supply to input power source.

⚠ **Warning:** *To avoid possible personal and equipment damage, the power supply must not be installed until all installation procedures are completed.*

3. Repeat steps 1 and 2 for each chassis and power supply.

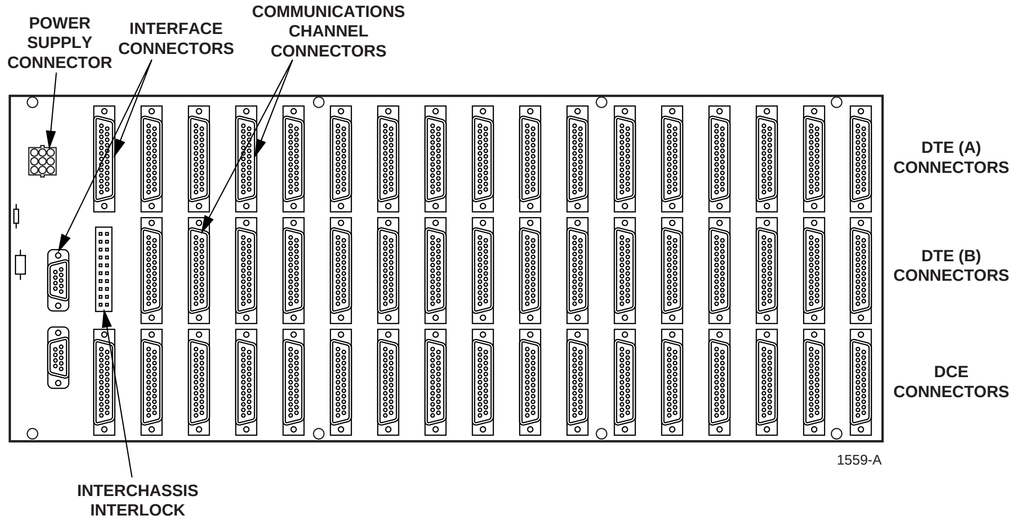

Figure 6-1. RDC-01/02 PatchSwitch Chassis Rear View

1.5 Communications Network Interface Connections

The back of each PS chassis (see Figure 6-1) contains 50 standard D-sub 25 pin connectors used to interface PatchSwitch modules with a communications network. In the top row, beginning at the right in the illustration, the first 16 connectors (DTE A) are for connecting PatchSwitch modules to Computer circuits via customer supplied cables. The 16 connectors in the center row (DTE B) connect PatchSwitch modules to alternate Computer circuits via user supplied cables. The first 16 connectors in the bottom row (DCE), connect PatchSwitch modules to modem circuits via user supplied cables.

The top and bottom connectors of slot 17 are usually connected to test equipment so that a DTE or DCE may be connected to the test equipment via patch cord and the interface module.

With the PSR-06 RS-422/RS-232 Interface Converter Module installed in the PatchSwitch chassis (slot position 17), the top connector of slot position 17 provides the connection point for the RS-232 control device (modem, computer, CRT or RCU). Two 9-pin female type D-sub connectors on the backplane of the chassis provide for CM interface with another PS chassis. The bottom connector of slot position 17 is not used in this case. An eight position programming plug is provided on the PSR-06 Interface Converter printed circuit board for assigning the PatchSwitch assembly as a DTE or DCE device.

When system is directly connected to a terminal or computer the PSR-06 Interface Converter module should have the programming plug in the DCE position (see Figure 6-2). A straight through cable can then be used to connect the top connector of slot 17 to the terminal of computer. When system is connected to a modem, the PSR-06 Interface Converter module should have the programming plug in the DTE position. Make sure the programming plug is inserted into the correct DIP Socket, DTE or DCE as appropriate. There is also a two position Berg Strap used on the Berg Posts labeled DSR. In DTE mode, position the strap on the bottom and center post and in DCE mode position the strap on the top and center post. Refer to Figure 6-2 for illustration of Berg strap and programming plug.

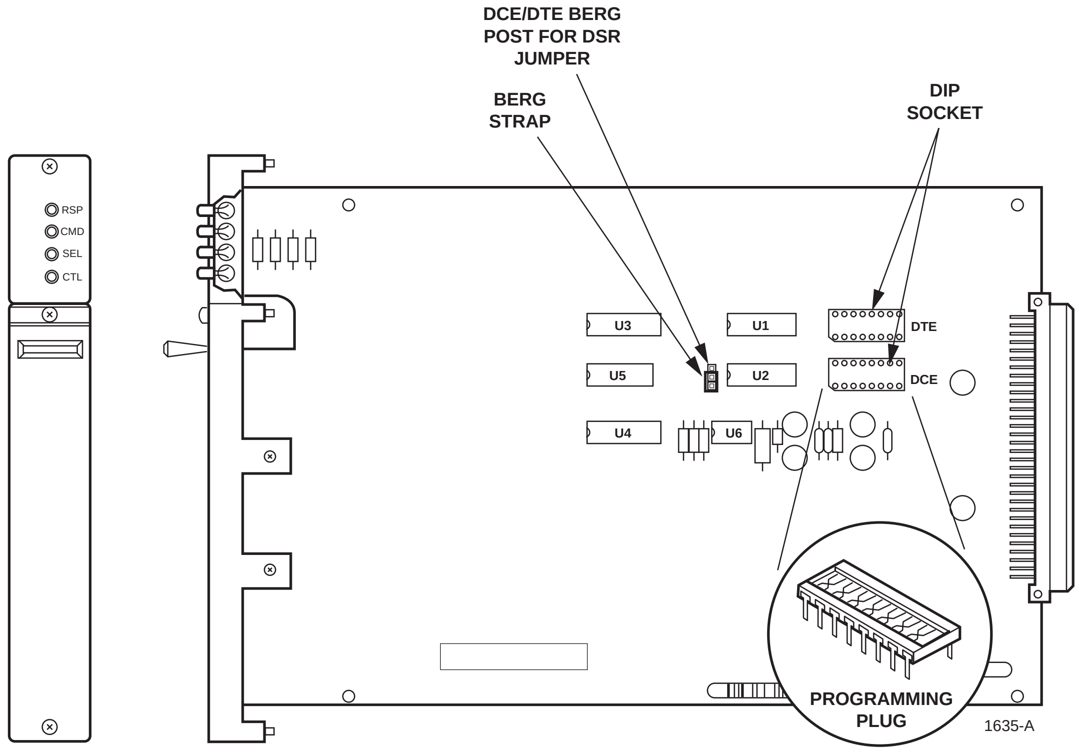

Figure 6-2. Data Converter Module

1.6 Control Module DIP Switch Settings

When PatchSwitch equipment is configured for serial remote control, the chassis address must be selected on each control module. For dc pulse control, the chassis address is ignored. Each CM contains a four-position DIP switch to identify its chassis address. Bit positions 1 through 4 on the DIP switch are set to an identifying address assigned to that chassis during the installation of the PS chassis system.

Caution: *Make certain that each chassis on a communications channel is assigned a different (unique) identifying address in the range of 0 through 15 (000_2 through 1111_2).*

Table 6-1 shows the binary switch settings corresponding to the identifying PS chassis addresses.

Table 6-1. Control Module DIP Switch Address Settings

SWITCH POSITIONS FOR BINARY ADDRESSES				PS CHASSIS ADDRESS
1	2	3	4	
On	On	On	On	00
Off	On	On	On	01
On	Off	On	On	02
Off	Off	On	On	03
On	On	Off	On	04
Off	On	Off	On	05
On	Off	Off	On	06
Off	Off	Off	On	07
On	On	On	Off	08
Off	On	On	Off	09
On	Off	On	Off	10
Off	Off	On	Off	11
On	On	Off	Off	12
Off	On	Off	Off	13
On	Off	Off	Off	14
Off	Off	Off	Off	15

Some older control modules only allow addresses up to “07”. These can be identified by the digits –7702 at the end of the part number. Models with digits –7708 or –7709 are capable of addresses to “15”. Both can be intermixed in a system as long as the –7702 versions are assigned addresses of “07” or below.

A switch in the ON position represents a zero (0) bit, and conversely, a switch in the down position (not ON) represents a one (1) bit.

For example, when facing the component side of the CM circuit board, the address for the chassis number 10 is set as shown in Figure 6-3.

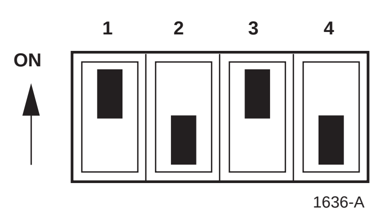

Figure 6-3. Control Module DIP Switch Settings for Chassis 10

2 CONTROL MODULE AUTOFALLBACK JUMPER INSTALLATION

When the autofallback option is selected, the proper jumper must be installed on the CM (Figure 6-4) before the module is installed in the PS chassis. Each CM has a group of four jumper selections located on the side of the circuit board. Refer to Figure 6-5 for an illustration of the autofallback jumpers.

If the jumper is installed in the “AUTO SW B” position, an alarm condition on any module within the PS chassis will cause switching to the “B” position from the “A” position. Similarly, if the jumper is in the “AUTO SW A” position, an alarm condition will cause a switch, to the “A” position from the “B” position. If the automatic switching is not desired, leave the jumper in the “STORE” position.

When installed, the autofallback selection does not override the CM software selection. That is, the software can change the switch position when the jumper strap is installed. However, if the alarm condition persists, the autofallback feature switches it back.

Caution: *Do not jumper both the “AUTO SW A” and “AUTO SW B” at the same time. This type of installation causes the circuits to switch positions every time an alarm condition is sensed, and can cause “hunting” if both A and B alarm persists.*

It is recommended that systems configured for autofallback have all modules strapped for auto alarm reset.

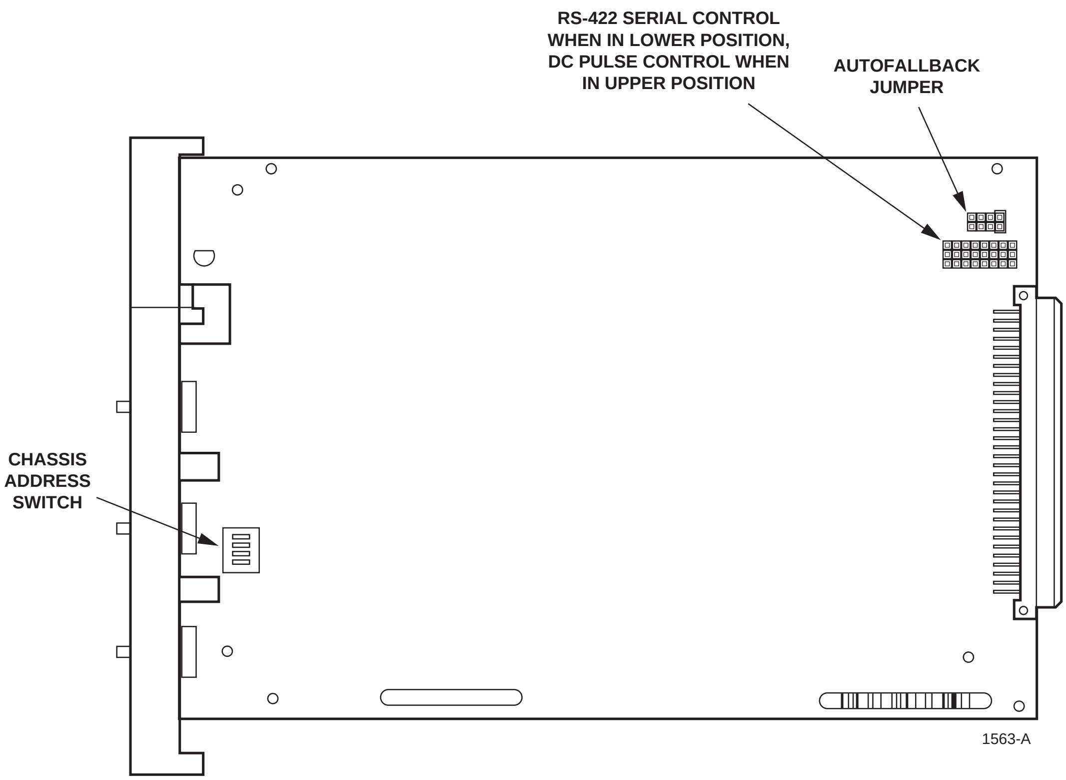

Figure 6-4. Control Module RDM-15

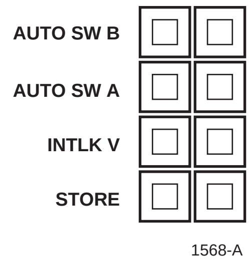

Figure 6-5. Autofallback Jumpers

3 CONTROL MODULE REMOTE CONTROL JUMPER INSTALLATION

The CM is factory set to configure the 9-pin D-subminiature connector as an RS-422 serial port. When the dc pulse control bank switching option is selected, the 2 × 8 jumper block must be installed on the dc pulse control side of the 3 × 8 jumper selections. Refer to Figure 6-6 for illustration of the Remote Control Jumpers.

⚠ **Caution:** *Incorrect strapping of remote control jumpers may result in damage to components and/or inadvertent switching.*

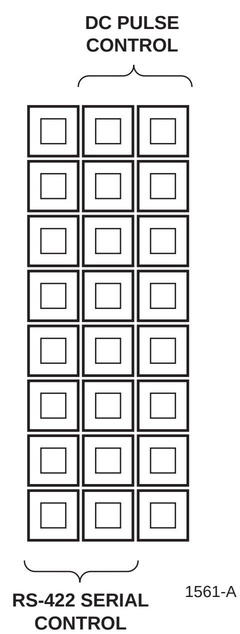

Figure 6-6. Remote Control Jumpers

4 PS MODULE JUMPER INSTALLATION

4.1 Interlock Jumper Installation

If an interlock option is desired for the system, the proper jumper must be connected in each A/B Switching Module before it is installed into the chassis. Each A/B Switching Module has five interlock jumper positions. One jumper position for each of four interlock groups (labeled “1” through “4”) and one vertical interlock group (labeled “V” or “Store”). Refer to Figure 6-7 for the location of the jumpers on the module.

Interlocking is used to protect the user from accidentally switching a common backup piece of equipment onto two or more different data lines. This is accomplished by allowing only the first module in that group to switch. The remaining modules remain in the “normal state” or the “A” position. Modules in the “B” position once switched to “A” will remain in the “A” position.

The three classes of interlock groups available are:

1. Global Interlock: Groups 1 and 2 are global and my be extended to all chassis at an installation, using an interchassis interlock cable. With this grouping, all modules having a jumper on group 1 make up one group, and all modules with a jumper on group 2 make up the other group (providing interchassis cables are installed between chassis).
2. Horizontal Interlock: Groups 3 and 4 are horizontal and they include only modules in the individual chassis. With this grouping, all modules in a chassis having a jumper on group 3 make up one group, and all modules having a jumper on group 4 make up the other group. These groupings do not extend out of the chassis and are not affected by the interchassis cable.
3. Vertical Interlock: The vertical interlock jumper position is labeled with the letter “V”or the word “Store”. Installing a jumper on this position interlocks all modules in the same slot location in other chassis having a jumper on the same (V) position. (Providing an interchassis interlock cable is in place between the chassis). The interchassis interlock cable is a 20 position ribbon cable with a 20-pin connector for each chassis.

The interlock group jumper block must only have zero or one jumper installed. Never try to have more than one interlock jumper on any module.

4.2 Alarm Jumper Installation

The alarm jumper must be installed before the module is installed in the chassis. Each module with the alarming feature has eight alarm jumper positions. Refer to Figure 6-7 for the location of the jumpers. Select the signal whose absence triggers the alarm, and place the jumper in the appropriate position. Only one signal may be selected for alarm detection.

4.3 Automatic Alarm Reset Jumper Installation

The automatic reset jumper must be installed before the module is installed in the chassis. Each module with the alarming feature has automatic reset and store jumper contacts in the lower right corner of the component side as shown in Figure 6-7. The alarm automatically resets when the jumper is on the left set of contacts. The jumper may be stored (i.e., the alarm does not automatically reset) on the right set of contacts.

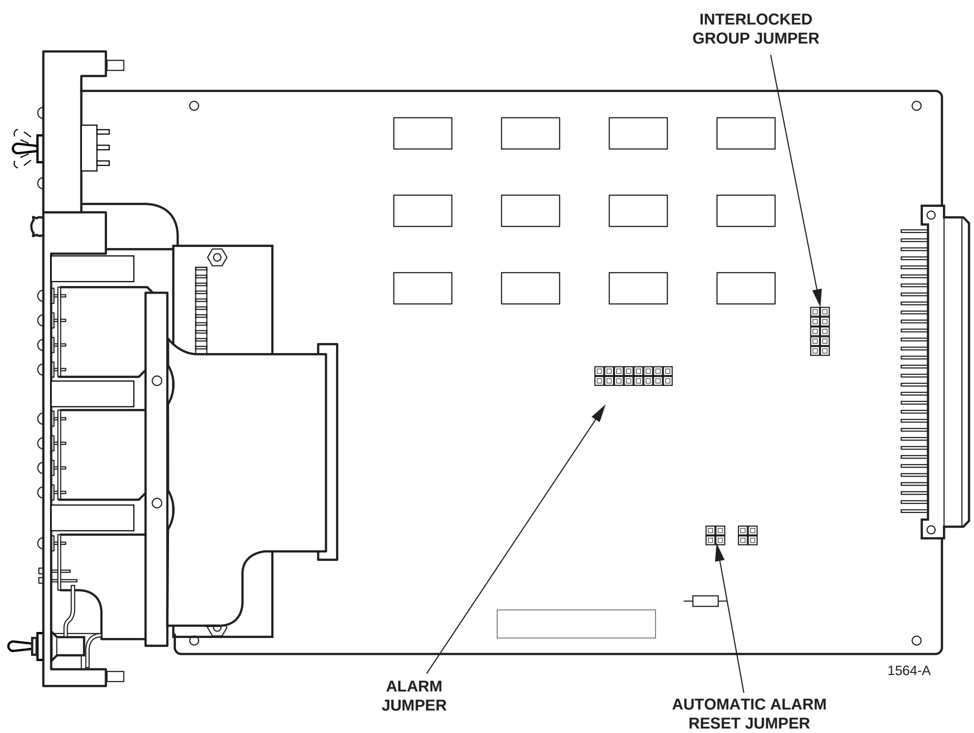

Figure 6-7. Jumper Locations

SECTION 7: OPERATION

Content **Page**

1 GENERAL

The PS equipment functions in either patching or switching methods of operation. The patching operations include intrusive monitor and interface while the switching operations are performed either locally or remotely.

2 PATCHING — IN-LINE ACCESS MODULES

In patching operations, patch cord connections are made through the front of the PS equipment modules. Those areas to be patched (communications network equipment) are connected to connectors on the rear of the PS equipment chassis. Refer to Figure 6-1 in Section 6 of this manual. All patch cords for use on this equipment are listed in Table 1-2 in Section 1 of this manual.

2.1 Monitor Patching

Monitoring patching is performed by inserting a patch cord into the MONITOR jack of a PS equipment module. This provides a bridge connection to the RS-232/V.24 circuit, and this connection induces no interruption of the circuit. Now that the data circuit has been accessed, the other end of the patch cord can be inserted into the jack of an Interface Module that has test equipment attached to it. This monitor function can also be accomplished by patching a monitoring device (e.g., data line monitor) directly into the desired MONITOR jack circuit.

2.2 Intrusive Patching

Intrusive patching is used to perform a restoral function on a failed component, to make a substitution of a different device, or to reroute a communications path. The patching function is activated by inserting a patch cord into either the COMPUTER or MODEM jacks of a PS equipment module. This action splits the circuit and routes the signals through the patch cord. The other end of the patch cord can then be inserted into another jack and in so doing, attach a different device. For example, it has been determined that a particular circuit has a bad modem. A patch cord is then inserted into that COMPUTER jack, and the other end of the patch cord is connected to the jack of a spare modem. This patching function has split the original circuit, rerouted the computer signals through the patch cord, and finally connected the spare modem to the original data communications circuit.

Tandem operation of computers and/or modems is not recommended; and consequently, patch cords should not be used to connect a COMPUTER jack to another COMPUTER jack or MODEM jack to a MODEM jack.

3 PATCHING — OFF-LINE ACCESS MODULES

When the module is in the normal (A) state the upper port provides patch cord access to the upper “D” subminiature connector on the chassis rear panel, thus providing a “monitor” function. When the module is in the “B” or “sub" state, this port provides direct test access to the off-line device.

The middle port functions in a similar manner for the middle connector on the chassis rear panel. When in the “B” state, monitor access; “A” state, test access to the off-line “B” device. The lower port provides intrusive access to the lower connector on the chassis backplane. Insertion of a patch cord in this port, regardless of switch status, breaks the circuit and connects the patchcord to the common (DCE) device.

4 INTERFACE MODULE

When an Interface Module is used, it is connected by inserting a patch cord into the MONITOR, COMPUTER, or MODEM jacks of a PS equipment module. This provides the access to these jacks to insert test equipment. The computer and modem circuits are split so their operation is affected. This is not true in the case of the monitor circuit. Test equipment, in this case, is connected to the chassis rear interface connector(s).

4.1 Test Module

When a test module is used, it is connected in the communications line to access test equipment. This is first accomplished by inserting a patch cord between either the MONITOR, COMPUTER, or MODEM patch jacks of a PS equipment module and the test module patch jack. The test module provides two RS-232/V.24 ports for connecting test equipment on the rear of the module. Refer to Section 2 for a detailed functional description of the test modules.

5 SWITCHING

All PS module switching operations are performed in conjunction with the Control Module (CM). The Control Module is used to enable the switching of all the modules contained in the PS chassis. Modules in a PS chassis can be switched individually or all at one time (bank switching). The switches located on the individual modules and Control Module are listed in Table 7-1.

A bank switching operation switches all of the A/B modules in a PS chassis to either the “A” position or “B” position. Both individual and banking operations may be done either locally or remotely.

⚠ **Caution:** *The bank switching feature is not compatible with the group interlock feature. If no module in an interlocked group is in the B state when a bank switch to the B state is initiated, the first module in this group will switch to the B state. Data may be lost when more than one module is in the B state. If one module in an interlocked group is in the B state when a bank switch is initiated, the rest of the modules in that interlock group do not switch to the B state; consequently, the system maintains its integrity.*

Table 7-1. Control Switches

NAME	FUNCTION	USED ON
AB MASTER Momentary Toggle	A/B switch operates all 16 chassis modules with A/B switching function to the A or B DTE channel position.	PS Chassis Control Module (RDM-15B)
ENABLE Momentary Toggle	In either up or down position, enables operator to make an A/B switch (both channel and gang).	
ALARM RESET Meomentary Toggle	In either up or down position, enables operator to reset PS chassis modules alarm(s) from on to off.	
AB Momentary Toggle Switch	Allows operator to switch from channel A to B or B to A.	All Switch Modules
RST Touch	Allows operator to reset alarm.	All Modules with Alarm Capability
Alarm Three Position OFF/ALM/LED	Allows operator to select OFF (LED off; audible alarm off), ALM (LED and audible alarm on), and LED (LED on, audible alarm off).	
DLY alarm Delay Eight Position Rotary	Allows operator to select eight different time delays for alarm operation.	

6 CONTROL MODULE SWITCHING (LOCAL)

The switch function designators for the three momentary toggle switches located on the front panel of the control module are termed:

1. A/B MASTER
2. ENABLE
3. ALARM RESET

6.1 Interface Converter Module (PSR-06A)

The Interface Converter Module is used in conjunction with the Control Module to provide compatibility between a PatchSwitch Control Module and an RS-232 control device (modem computer, CRT or RCU). Only the first PS Chassis in a group needs to have a PSR-06A installed.

6.2 Single Channel Switching

To switch a PS module, the operator toggles the ENABLE switch to either off-center position while simultaneously toggling the channel's A/B switch (located on the PS module) in the desired direction. The channel switching operation does not require the operator to maintain the toggled position of either switch while waiting for the module switch function to occur. Once the toggling operation is performed, the circuitry senses the switch change and completes the module switching operation upon receiving an internal timing signal.

6.3 Bank Switching

Bank switching is performed by the operator toggling the A/B MASTER switch (located on the Control Module) to either the A or B position and then toggling the ENABLE (directly below the A/B MASTER switch) switch (off-center position). This operation causes all of the PS chassis modules to switch to the channel (A or B) corresponding to the selection of the A/B MASTER switch. To avoid a slight delay in the switching operation, the A/B MASTER switch should be held in position (A or B) while toggling the ENABLE switch.

Bank switching starts with module 0 (slot l) and ends with PS chassis module 15 (slot 16). The individual module A/B switches are disabled while the A/B MASTER switch is toggled in either the A or B position.

6.4 Reset Alarms

To reset the module alarms, the operator toggles the ALARM RESET switch (located on the Control Module) to either off-center position. If a constant alarm condition exists, the yellow LED indicators for each module sensing an alarm remain lit and the audible alarm remains activated, if enabled. If a constant alarm condition no longer exists, toggling the ALARM RESET switch extinguishes all of the module alarm LEDs (yellow) and silences the audible alarm.

The alarm reset function clears all the alarm circuits. An individual module alarm circuit may be selectively reset by touching the two posts on the alarming module.

6.5 DC Pulse Control Switching

The PatchSwitch Control Module is capable of Bank switching the PS chassis modules which perform A/B switching by responding to dc voltage pulses received over the communications channel from a remote device. In order to enable dc pulse control, the remote control jumper block must be set to the dc pulse control selection. Bank switching via (signal ground), +5V or –5V to –48V dc to the corresponding lead (see Table 2-2 for pin assignments) for a minimum of 250 msec and should be removed within 1 sec after application since all other switching functions are disabled during this time.

Note: If a “switched to” A dc voltage level is applied while a “switched to” B dc voltage level is active, all modules will switch to the A position but will be restored to the B position after the “switched to” A signal is removed, provided the “switched to” B signal remains active.

As with front panel bank switching, all modules in the PS chassis will switch to the channel (A or B) corresponding to the dc voltage applied per Table 2-2.

Bank switching starts with module 0 (slot 1) and ends with PS module 15 (slot 16). The individual module A/B switches are disabled while the dc voltage is present.

6.6 Remote Control Switching

The PatchSwitch Control Module is capable of controlling the PS chassis modules by responding to commands received on the communications channel from a remote control device with the remote control jumper block in the RS-422 serial communications position. The CM also monitors the status of the PS chassis module A/B switches and alarm conditions and reports this information to the requesting remote control device via the same communications channel.

There are three types of devices which can remotely control a PatchSwitch system:

1. ADC Model SSN-100589 software running on a personal computer (PC)
2. User's terminal or computer
3. PatchSwitch Remote Control Unit (RCU)

The PatchSwitch Remote Control Unit (RCU) is described in a separate publication. Refer to ADC Publication Number ADCP-50-302, PatchSwitch Remote Control Unit User Manual for operating instructions.

The following information enables the user to communicate between a PatchSwitch Control Module (CM) and terminal or computer. This portion of the manual describes the ASCII commands executed by a terminal for performing the switching and monitoring functions of the PS chassis modules.

6.7 Remote Control Commands

Commands are issued by the remote control device to: l) select the desired PS chassis; 2) perform the selected module(s) AIB switching operations; 3) request the status of the selected chassis PS modules; 4) request the selected CM software revision level; 5) enable/ disable alarm reporting; 6) clear all alarm reporting conditions; and 7) de-select PS chassis.

6.8 Command Conventions

Remote control devices must issue commands compatible to the CM software. When entering commands on an ASCII keyboard, observe the following conventions.

String Entries. All keyboard commands are entered in ASCII character strings. Each command string must contain a Carriage Return (CR) and a Line Feed (LF) character for a command terminator. The CM command string buffer can hold up to forty (40) characters. This number includes the CR/LF characters, terminating the command string.

Backspace (control-H) and delete-line (control-U) characters are recognized by the CM software and are valid in the command string. There is no distinction between upper and lower case alpha characters as the CM software converts all lower case alpha characters to upper case (caps).

Parameter Entries. Command parameters are usually separated by commas, although a parameter separator may be any non-digit (0-9) character. There are no restrictions on the number of blank character spaces or zero characters preceding (or leading) the parameter, except for the 40 character buffer limit.

Non-digit and non-blank characters are recognized by the CM software as parameter separators. Therefore, two such consecutive characters (non-digit and nonblank) are recognized as a null parameter. Each null parameter is replaced with a default value assigned by the CM software. If the null parameter does not have a legal default value assigned to it, the CM issues an error message to the remote control device.

6.9 Command Flags

Two flags are used to inform the CM when to execute an incoming command. The two command flags are:

1. Execute Flag
2. Echo Flag

Note: These flags DO NOT apply to select/ de-select PS chassis commands (TLK, CRT, SPK, SC, UNT) and the GO command. Command flags are applicable to the commands (AB, IN, UP, REV, AL) issued to request switching, status or reset (clear alarms).

Execute Flag. Any valid command string containing a pound sign (#) character causes the CM to execute the command immediately. The “#” character may be located anywhere within the command string and may appear as a parameter separator.

Echo Flag. Any command character string containing the dollar sign ($) character causes the CM to re-transmit the command string to the remote control device. This permits the operator to review and verify the parameter selections previously entered and transmitted to the selected PS chassis. If the parameters are valid, but incorrectly entered, the operator should re-enter the command string.

When a command string contains “$” characters, the CM software saves the command. The command remains stored in the CM until a GO command is recognized. When a GO command is recognized, the software attempts to execute the command string received (currently stored) just prior to GO command. If the command is invalid, an error message is returned to the sending device. If the character string is a valid command, the actions defined by the command are executed. After the command is executed, the command is erased by the system software. Any subsequent GO commands are ignored by the CM until the next command string is received. The “$” character may be located anywhere within the command string and may appear as a parameter separator.

6.10 Command Interpretation

All valid commands must appear as the first characters in the string. Characters appearing after the command (as well as any parameters) do not affect the CM command interpretation. For example, the system would correctly interpret the GO command from the following character strings:

GO-JUMP/IN THE LAKE

GOPHER STATE

In the next example, the system would not interpret the GO command from the strings:

bGO (b meaning blank)

GGO

As previously stated, commands may be entered in either upper or lower case alpha characters. Case has no effect on the CM interpretation.

6.11 Command Responses

Whenever an activated (selected) PS chassis receives a command string, the CM responds by sending one of the following character strings to the terminal (remote control device):

RDYxx

MSGxx

ERRxx, (error code)

The characters “xx” identify the chassis (CM) originating the response. The identification characters “xx” have a value in the range of 00-07.

If the last command did not execute properly, or if the command parameters (or syntax) were invalid, the CM returns an error message containing an error code. The error codes are defined at the end of this section.

If a change in the PS chassis occurred after the CM transmitted the last status information to the remote control device, the CM responds with MSGxx.

Note: If a temporary status change occurred and the status of the chassis returned to the status last transmitted, the software does not indicate a change. That is, the CM does not respond with MSGxx.

If neither an error condition or status change occurred since the chassis responded to the last command, the CM responds with RDYxx.

6.12 Command Descriptions

The CM responds to ASCII character commands received on the connected communications data channel. These commands provide the user with the following functional operations:

1. Select PS Chassis
2. Request Software Revision Level
3. Request Status
4. Reset Alarm Status
5. Enable/Disable Alarm Status Reporting (valid only with CRTxx)
6. Request Switching
7. De-select the PS Chassis

6.13 Select PS Chassis Command

The remote control device selects a PS chassis by issuing an activation command containing the chassis' identification number. Chassis' identification numbers are determined by the settings on the DIP switch located on the chassis CM. Refer to Section 6 for a description of the DIP switch settings.

There are four different select commands acceptable by the CM. The first three select commands identify the type of remote control device connected to the data communications channel. The fourth command selects multiple chassis simultaneously. The four different select commands are defined and used as follows:

TLKxx Command (talk) issued by a terminal user to select PS chassis xx

Note: The identification "xx" must be characters in the range 00- l5.

SPKxx Command (talk) issued by the PatchSwitch Remote Control Unit to select PS chassis “xx”.

CRTxx Command (talk) issued by the SwitchMate Intelligent Controller to select PS chassis “xx”.

SC, xx, xx, xx xxCommand (Super Chassis) issued by a terminal user to select multiple PS chassis simultaneously. Up to sixteen chassis may be selected (e.g., 00, 01, 02, 05, 07 or “all” for sixteen).

If the chassis identification (xx) number in the “TLK”, “CRT” or “SPK” command on a CM matches the DIP switch settings, the identified chassis is selected. If the chassis identification number in the command does not match the DIP switch settings on a CM, the chassis is de-selected. When setting the CM DIP switches, the user must ensure that no two CMs have the same identifier (address). Refer to the Installation Section, Section 6, for the DIP switch selection procedure.

When the Super Chassis (SC) command is used to select multiple chassis, each selected chassis identification (xx) number (parameter) is entered in a string using commas for parameter separators. All other chassis in the system are de-selected.

6.14 GO Command

The GO command requests the selected PS Chassis to execute the command string that immediately preceded the GO command. Normally, the GO command is issued by the user after the remote control device receives a RDYxx response. Once the pending command is executed, subsequent GO commands received by the CM software are disregarded. The GO command string is terminated with the CR/LF characters.

6.15 Request Software Revision Level (REV) Command)

The REV command requests the CM to transmit the software revision level. The REV command string must contain a command flag (# or $) prior to the line feed (LF) character. If an echo flag occurs in the command string, the user must issue a GO command before the PS chassis will return the revision level message. When the remote control device sends the "REV#CRLF" command string, the selected PS chassis respond with the following message:

Patch Remote Control Module
Revision x.y
Copyright ADC Telecommunications, Inc.

The characters x.y above represent the revision level of the software.

6.16 Request Status (UPdate Command)

The UPdate command requests the CM to transmit the status of all the modules contained in the selected PS chassis. The UPdate command string must contain a command flag (# or $) prior to the string terminating CR/LF characters. If an echo flag ($) occurs in the UPdate command string, the user must issue a GO command before the PS chassis status is transmitted.

6.17 Status Responses

Status is transmitted from the CM to the requesting remote control device in one of three formats. The format transmitted depends upon the type of select command used when the chassis is originally selected. If the "TLKxx" command activated the PS chassis, the status response formats outlined in Table 7-2 through Table 7-5 are returned. The status response format associated with the "SPKxx" command is outlined in Table 7-6. The status response format associated with the "CRTxx" command is described in the SwitchMate Switch Cluster Controller Software Specification, ADCP-50-595.

6.18 TLKxx Format

When using the TLKXX format, control is by means of menu selections, module position entries, and control keys. Each of these are described in the following paragraphs.

6.18.1 Menu Selection

When using the TLKxx format, most data entries are through menu selections. All menus are described later in this section as part of the operating procedures.

The > symbol shown with each menu is the "invitation to type", indicating that system is waiting for operator input. Default key-ins are shown in parenthesis. A dash in parenthesis indicates that there is no default selection for the menu.

(–) > — To enter a selection, type selection number and press RETURN.

(3) > — The number in parenthesis indicates the default selection. To enter a different selection, type desired selection number and press RETURN. If number in parenthesis is the number of the desired menu item, just press RETURN.

6.18.2 Module Position Entries

Some displays are instructions to enter the numerical module positions of A/B Switch Modules. To enter module numbers enter each number, separated by commas (Example: 3, 7, 11, 14) and press RETURN. The comma is always used as an input delimiter.

Two or more A/B Switch Module numbers in a sequence may be entered as a group by entering the lowest and highest numbers in the sequence, separated by a dash (Example: l-4). Entering 3-l5 will select modules 3 through 15. To enter all module numbers, only the letter A needs to be entered.

6.18.3 Control Key

The Ctrl X key may be pressed at any time during TLKxx operation to return control to the previous menu or deselect the chassis.

6.18.4 Status Displays

Various types of switch displays occur frequently in establishing switch configurations. These are described in Table 7-2.

Table 7-2. Status Displays

STATUS DISPLAY	DISPLAY DEFINITION
Status Display #1	
Chassis No. Xx	Chassis No. XX — XX = the chassis number for which status is displayed.
Module # 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Module # — Module numbers on selected chassis for which switch status is displayed. Module 0 is defined as the module in the leftmost position in the chassis.
Sw Status a/b/n/m/l/q/-	Sw Status — Current switch status on each of the indicated modules. a — Equipment channel A is selected on A/B Switch Modules. b — Equipment channel B is selected on A/B Switch Modules. n — Normal Mode is selected on Test Access Modules. m — Monitor Mode is selected on Test Access Modules. l — Line Mode is selected on Test Access Modules. q — Equipment Mode is selected on Test Access Modules. - — Indicates blank slot (not occupied by any module).
Failed Act	Failed Act — Previous command did not execute correctly. ^ — Indicated module failed to perform command action. Blank - Indicated module completed command action.

6.19 TLKxx Execution

CRT actions and displays involved in operating in the TLKxx format are shown in Figure 7-1 and defined in Table 7-3.

Enter TLKxx with xx equal to the two-digit chassis address (00 to 15) and press RETURN.

Completion of chassis selection always results in a status display of the selected chassis followed by the Select Operation Menu. If the chassis had previously been selected by the SC command and a GS command was executed, the status display is preceded by a message indicating successful or unsuccessful execution of the command. SC and GS commands are described later in this section.

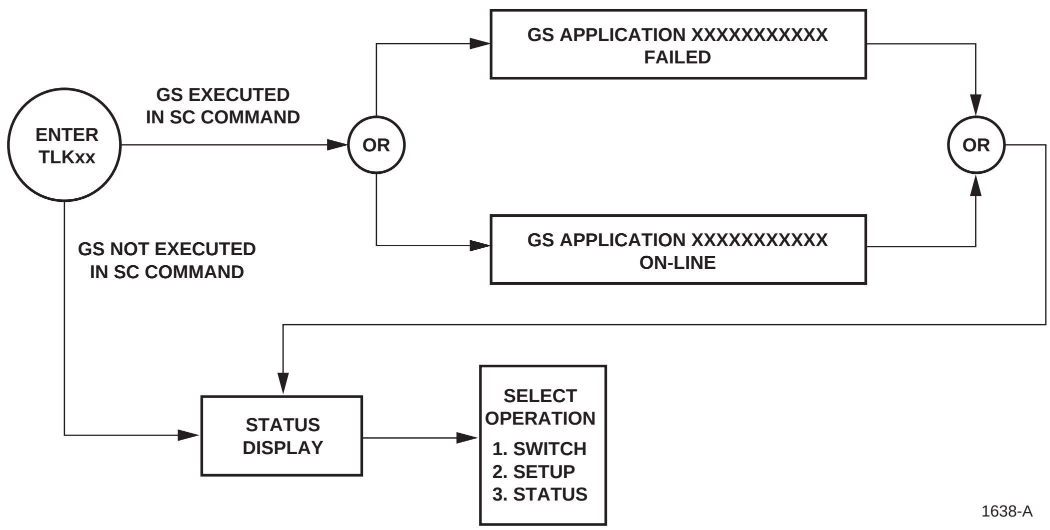

Figure 7-1. Chassis Selection and Configuration via TLKxx Command

Table 7-3. Chassis Selection and Configuration via TLKxx Command

ACTION DISPLAY	DISPLAY DEFINITION
Enter: TLKxx	Request to talk with chassis number xx, with xx equal to any chassis number from 00 to 15. (Two digits must always be entered for chassis number.)
Entry of TLKxx displays: GS application xxxxxxxxxxx on-line	The selected chassis has been configured for Application xxxxxxxxxx (name of up to eleven characters). This is displayed only after use of the GS selection.
or GS application xxxxxxxxxxx failed	An attempt was made to configure the selected chassis for Application xxxxxxxxxxx, however the chassis was not correctly configured. This is displayed only after use of the GS selection.
followed by: Chassis No. XX xxxxxxxxxxx Application Module # 0 l 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Sw Status	Switch status as defined in Table 7-2.
Select Operation l. Switch 2. Setup 3. Status	Allows entry of switch and setup conditions.
Enter switch and setup conditions as described in Figure 7-2 and Figure 7-3 and in Table 7-4.	

6.19.1 Changing Switch Status

All menus and selections involved in establishing access module switch configurations are shown in Figure 7-2 and defined in Table 7-4. The Main Menu, Select Operation, immediately follows the opening status display or completion of a previous operation.

6.19.2 Saving a Current Configuration

Up to five different switch configurations can be stored in memory for use at a future time. All displays and actions involved in storing of a configuration after it has been established are shown in Figure 7-3 and defined in Table 7-5. Procedures for selecting and using a stored configuration are defined in Figure 7-2 and Table 7-4.

The first menu in saving a current configuration is Select Operation, which immediately follows the opening status display or completion of a previous operation.

6.19.3 Select Operation Menu

The main menu used for establishing switch configurations is the Select Operation Menu. This is the first menu displayed after the status display.

Table 7-4. Change Switch Selection

ACTION/DISPLAY	DISPLAY DEFINITION
Enter 1. Switch from the Select Operation Menu to display the present switch status followed by: Select Switch Action l. Normal (A) 2. Substitute (B) 4. Configuration Switch Ctrl X To Exit (--) >	l. Normal (A) – Selects Equipment channel A on A/B Switch Modules. 2. Substitute (B) – Selects Equipment channel B on A/B Switch Modules. 3. Invert (A/B) – Reverses the Equipment channel A/B selection on A/B Switch Modules. 4. Configuration Switch – Allows selection of one of five predefined switch configuration presently stored in memory. Ctrl X – Redisplays the Select Operation Menu.
Enter the desired switch action from the Select Switch Action Menu. Selection of any of the options 1 through 7 on the Select Switch Action Menu Displays: Card Selections — Key in Card Position(s) or A for all. Ctrl X to Exit Followed by one of the following as determined by the selection from the Select Switch Action Menu: Switch to (A) Normal Switch to (B) Substitute Invert Switch Status Switch to Monitor Break to Equipment Break to Line (--) >	Allows one or more A/B Switch Module to be switched to the selected configuration. Ctrl X – Redisplays the Select Switch Action Menu.
Enter the card position numbers (0 to 15) of the A/B Switch Modules to be switched to the selected configuration. Use commas as delimiters, or a dash if a range is entered. If all A/B Switch Modules are to be switched to this configuration, enter A. Command Action Complete Chassis No. xx Module # 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Sw Status or Current Application Module # 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Sw Status Failed Act Command Action Incomplete Retry Command? l. Yes 2. No Ctrl X To Exit (2) >	Switching actions have occurred as commanded. Switch status as defined in Table 7-2. Switch status as defined in Table 7-2. Switching actions have not occurred as commanded. 1. Yes – Reattempts last switch action. 2. No – Does not reattempt last switch action, and redisplays the Select Switch Action Menu. Ctrl X – Redisplays the Select Switch Action Menu.

Table 7-4. Change Switch Selection, continued

ACTION/DISPLAY	DISPLAY DEFINITION
Enter 7. Configuration Switch from the Select Switch Action Menu to display: Select Configuration l. (11 Characters) 2. (11 Characters) 3. (11 Characters) 4. (11 Characters) 5. (11 Characters) Ctrl X To Exit (--) >	Five selectable predefined chassis configurations, each identified by a 11-character name. Ctrl X – Redisplays the Select Switch Action Menu.
Enter the desired predefined configuration: This entry displays: Chassis No. XX xxxxxxxxxxx Application Module # 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Sw Status	Similar to status display shown in Table 7-2, except it shows the predefined configuration selected before it actually reconfigures the chassis.
This display is immediately followed by: Switch to Displayed Configuration 1. Yes 2. No Ctrl X To Exit (2) >	1. Yes – Reconfigures the chassis modules as displayed. 2. No – Redisplays the Select Switch action Menu to allow selection of a different configuration. Ctrl X – Redisplays the Select Switch Action Menu.
Enter l. Yes or 2. No Entry of 1. Yes displays either xxxxxxxxxxx Application Online followed by the Select Switch Action Menu	Reconfiguration occurred as commanded.
or Chassis No. XX Module # 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Sw Status Failed Act	Switch status as defined in Table 7-2.
Command Action Incomplete Retry Command? 1. Yes 2. No Ctrl X To Exit (2) >	Switching actions have not occurred as commanded. 1. Yes – Reattempts last switch action. 2. No – Does not reattempt last switch action, and redisplays the Select Switch Action Menu. Ctrl X – Redisplays the Select Switch Action Menu.

Table 7-5. Change Switch Status

ACTION/DISPLAY	DISPLAY DEFINITION
Enter 3. Status from the Select Operation Menu to display: Select Status Action l. Display Status 2. Save Current as Configuration Ctrl X To Exit (1) >	l. Display Status – Redisplays the current status followed Action Menu. 2. Save Current as Configuration – Allows storage of the place of one of the five presently stored configurations.
To save the current configuration enter 2. Save Current as Configuration from the Select Status Action Menu. This entry displays: Select Configuration to Display or Replace l. xxxxxxxxxxx 2. xxxxxxxxxxx 3. xxxxxxxxxxx 4. xxxxxxxxxxx 5. xxxxxxxxxxx Ctrl X To Exit Action Menu. (--) >	xxxxxxxxxxx – Eleven-character name of a previously stored configuration. Up to five configurations can be stored, each with a different eleven-character name, Undefined configurations are initially labeled ?????? Ctrl X – Redisplays the Select Status
Select the configuration memory location in which the current configuration is to be stored. Entry of this selection shows two status displays; the first shows the switch configuration as currently defined, and the second shows the switch configuration of the selected configuration to be overwritten. These displays are followed by: Replace xxxxxxxxxxx with Current Status? l. Yes 2. No Ctrl X To Exit (2) >	Allows comparison of the two configurations before actually overwriting the stored values with the current. l. Yes – Allows overwriting to be performed. 2. No – Redisplays the Select Status Action Menu for selection of a different configuration to be overwritten. Ctrl X – Redisplays the Select Status Action Menu.
Enter l. Yes if the current configuration is to be stored at the selected location. **Note:** The previous contents of this configuration memory will be lost after the current configuration is stored.	
This entry displays: Configuration Name Selection Key in up to Eleven Characters for Configuration Name Ctrl X To Exit (??????) >	Allows entry of a name for the new configuration to be stored.
Enter the eleven-character name to store the configuration. This displays:	
Configuration xxxxxxxxxxx Saved followed by the Select Status Action Menu.	xxxxxxxxxxx — Name of configuration (up to eleven-characters).

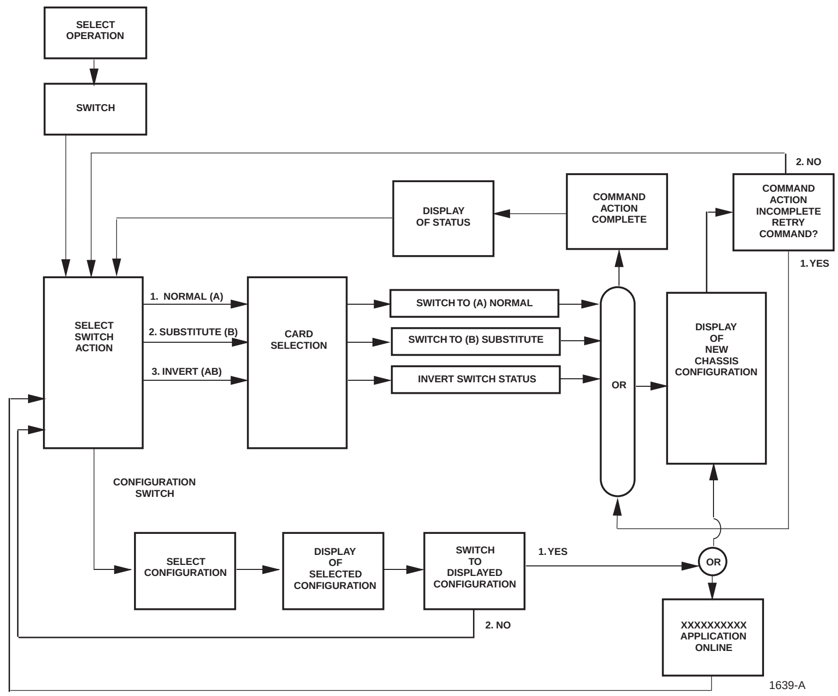

Figure 7-2. Changing Switch Status

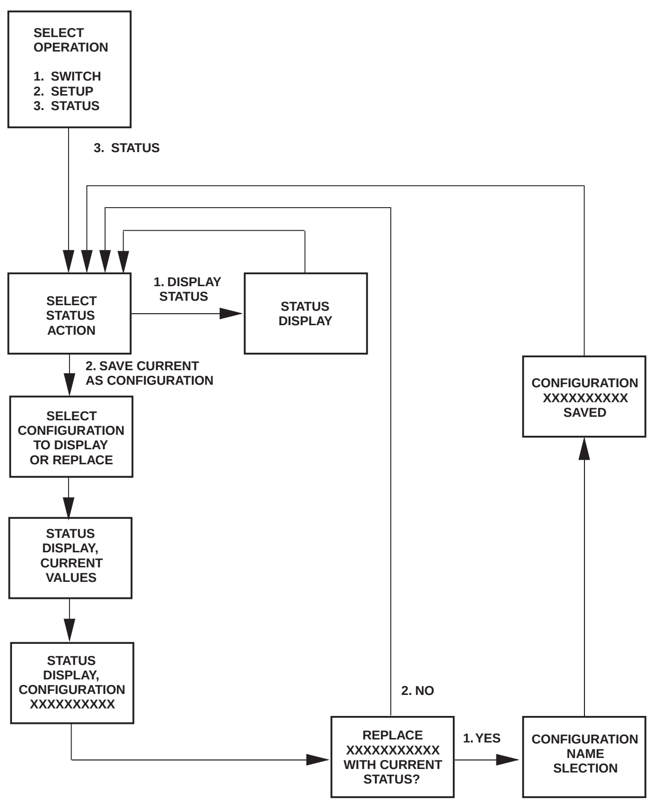

Figure 7-3. Saving a Current Configuration

6.20 SPKxx Format

When a remote control device selects a PS chassis by issuing a “SPKxx” command, and then requests status by issuing a “UP#” command, the CM responds with the condensed status format. The condensed status format is a string of eight hexadecimal digits representing the switch positions and alarm conditions for all 16 module slots contained in the selected PS chassis. The “SPKxx” command is used by the RCU.

Each digit displayed is a hexadecimal code representing the switch position or alarm condition for four PS modules. As shown in the example of Table 7-6, the first four hexadecimal digits “56A3” define the switch positions for all l6 modules. The first hexadecimal digit “5” is decoded to it’s binary equivalent which is “0101”. These four binary digits (bits) are assigned to module addresses 15 (most significant) through 12. The response is read from left to right with Module l5 assigned to the most significant bit in the hexadecimal code. A “0” bit indicates the module is in the ‘A’ switch position and conversely, a “1” bit indicates the module is in the “B” switch position.

The second, third and fourth hexadecimal digits (616, A16 and 316) are decoded to their binary equivalents which are “0110”, “1010”, and “00l1”, respectively. These 12 bits are assigned to module addresses 11 through 0 (least significant). In this example (56A3)16, modules 15, 13, 11, 8 6, 4, 3, and 2 are in the “A” switch position and modules 14, l2, 10, 9, 7, 5, l, and 0 are in the “B” switch position.

The alarm status for the same l6 PS modules is displayed in the last four hexadecimal digits “10l0”. The alarm status code is read in the same manner as the switch status code. The fifth hexadecimal digit “1” is decoded to it's binary equivalent which is “000l”. These four binary digits (bits) are assigned to module addresses 15 (most significant) through 12. A “0” bit indicates a no alarm condition for the module and conversely, a “l” bit indicates the module detected an alarm.

The second, third and fourth hexadecimal digits (0_{16}, 1_{16} and 0_{16}) are decoded to their binary equivalents which are “0000”, “000l”, and “0000”, respectively. These twelve bits are assigned to module addresses l l through 0 (least significant). Therefore, in this example $(1010)_{16}$, modules l2 and 4 indicate an alarm condition is detected and the remaining modules indicate no alarm is detected.

Table 7-6 shows an example of the condensed status format received by a terminal when a request for status is issued for PS Chassis 0l. This format is primarily used by the Control Module to transmit status to the ADC Remote Control Unit (PSR-03) indicator display.

Table 7-6. “SPKxx” Command Status Responses

KEY IN	RESPONSE	DEFINITIONS OR COMMENTS
SPK01	RDY01	Chassis 01 selected
UP		Request status update
	56A31010	$5_{16} = 01010_2 =$ Modules l5 and l3 in “A” switch position. Modules l4 and l2 in “B” switch position.
		$6_{16} = 0110_2 =$ Modules 11 and 8 in “A” switch position. Modules l0 and 9 in “B” switch position.
		$A_{16} = 1010_2 =$ Modules 6 and 4 in “A” switch position. Modules 7 and 5 in “B” switch position.
		$3_{16} = 0011_2 =$ Modules 3 and 2 in “A” switch position. Modules l and 0 in “B” switch position.
		$1_{16} = 0001_2 =$ Modules 15, l4, and 13 no alarm detected. Module l2 in alarm.
		$0_{16} = 0000_2 =$ Modules 11, l0, 9, and 8 no alarm detected.
		$1_{16} = 0001_2 =$ Modules 7, 6, and 5 no alarm detected. Module 4 in alarm.
		$0_{16} = 0000_2 =$ Modules 3, 2, 1, and 0 no alarm detected.

6.21 Reset Alarm Status (IN Command)

The IN (Initialize) command requests the CM to reset the alarm status in all the modules contained in the selected PS chassis. The IN command string must contain a command flag (# or $) prior to the string terminating characters. If an echo flag occurs in the IN command string, the user must issue a GO command before the selected PS chassis resets the alarm reporting status in the associated modules. When the terminal sends the “IN#CRLF” command, the CM software resets all modules that are indicating an alarm condition.

6.22 Enable/Disable Alarm Status Reporting (AL Command)

The AL (ALarm) command enables or disables the alarm status reporting for any one or all modules in the selected PS chassis. This command enables or disables the appearance of an alarm condition in the status response from the CM. Actually, the reporting PS chassis may have an alarm condition, but the software ignores this condition when the disable function is in effect. The AL command is a software function only, and does not change the state of the hardware when executed.

The AL command must contain a string of parameters for defining the action (enable or disable), the type of circuit card, the slot number where the action is to start and the slot number where the action is to end. The AL command string parameters must be in valid syntax and contain a command flag (# or $) prior to the string terminating characters. If an echo flag ($) occurs in the AL command string, the user must issue a GO command before the PS chassis enables or disables alarm status reporting for the selected module slots. If an execute flag (#) is contained in the AL command string, the CM executes the AL command string immediately when it is received.

The format for the AL command string parameters is as follows:

AL, <action>, <cardtype> , <startslot> , <endslot>,

<flag>CRLF

The CM issues an error message if any parameter value is not within the specified range of values. An error message occurs if the startslot value is greater than the endslot value.

➧ **Note:** Alarm conditions are always reported to a Remote Control Unit (PSR-03) and terminal.

Table 7-7 describes the syntax for the command string parameters and defines the software operations performed when the AL command is executed.

Table 7-7. Enable/Disable Alarm Stratus Reporting, AL Command String Parameters and Definitions

OPERATION	COMMAND STRING PARAMETERS	DEFINITIONS OR COMMANDS
Enable/Disable Alarm Status Reporting	Al, <action>, <card type> "'<startslot>, <endslot> ,<flag>	AL — indicates the following character string is an alarm enable/disable status command. <action> — Enable or disable alarm reporting. Where: 0 = disable alarm reporting; 1 = enable alarm reporting. No default value. <cardtype> = 15. Defines card type which must be AB (15). Default is 15. startslot> — Indicates first slot (module) in group selected for alarm action. Range: 0-15. No default. endslot> - Indicates last slot (module) in group selected for alarm action. Range 0-15. Default value is the same value entered for the start slot. <flag> — command flag. No default. Where: # = Execute $ = Echo followed by CR LF.
Examples:	AL,0,1,15,4,8$	Return command (echo) character string to originating terminal. Enter GO command to execute alarm-status-reporting command. Disables alarm-status-reporting for modules 4 through 8.
	AL,1 , ,6#	Enables alarm-status-reporting for module 6. Execute command immediately.

6.23 Request Switching (AB Command)

The AB command switches one or more modules contained in the selected PS chassis. This command permits the operator to assign an alternate path for circuit operation. The AB command also establishes the current position of the A/B switch for all selected modules.

The AB command contains a string of parameters that define the module slot(s) selected and the switch position (action) for the module(s). The AB command string parameters must be in valid syntax and contain a command flag (# or $) prior to the string terminating characters. If an echo flag ($) occurs in the AB command string, the user must issue a GO command to perform the switching operations. If an execute flag (#) occurs in the AB command string, the CM executes the AB command string immediately when it is received.

Caution: *When using Autofallback, the operator's switching commands may be negated. That is, modules in alarm state switch to the side specified by the jumper (A or B). This switching operation is performed regardless of the operator's commands.*

The The format for the AB command is:

AB , <namslot> , <numslot> , <numskip>, <action> ,<flag>

Table 7-8 describes the syntax for the command string parameters and defines the operations performed when the AB command executes.

Table 7-8. Request To Switch Module, AB Command String Parameters and Definitions

OPERATION	COMMAND STRING PARAMETERS	DEFINITIONS OR COMMENTS
Request to Switch Module	AB, <namslot>, <numslot>, <numskkp>,<action> <flag>	AB — indicates a switch request. namslot> — name of starting slot. Range: 0-15. No default. numslot> — number of slots to switch. Range: 0-15. Default = l. ALL = 0. <numskip> — number of slots to skip between switched slots. Range: 0-15. Default = 0. action> — indicates the action the switch is to perform. Range: 0-2. Where: 0 — switch to "A" 1 — switch to "B" 2 — toggle switch to opposite position. No default. <flag> - command flag. No default. Where: # = Execute $ = Echo
Examples:	AB,4,1,0,1#	Switch only slot 4 module to the "B" side. Execute command immediately.
	AB,0,0,0,0$	Return command (echo) character string to originating terminal.
	GO	Enter GO command to execute switch request (preceding character string). Switch all modules to the "A" side.
	AB,0,8,1,1#	Switch 8 slots (modules) to the "B" side, starting with module 0, skipping every other slot. Execute command immediately. Modules 0, 2, 4, 6, 8, 10, 12, 14 and l6 switch to the "B" side.
	AB,5,,,0#	Switch only module 5 to the "A" side. Execute command immediately.

6.24 Request Super Chassis Command (SC Command)

The SC (Super Chassis) command is a quick-switch feature used by the remote control device (terminal) to simultaneously select multiple chassis. This command is normally used in conjunction with a subsequent AB or AL command to perform AB switching and/or to enable alarm reporting after the chassis are selected. All chassis selected by the SC command, have their status response "silenced". That is, status is not provided by any chassis selected as a result of the SC command. All chassis specified for selection in the command become activated immediately upon receiving the SC command.

Note: Only the AB, AL and IN commands are valid commands associated with the SC command.

For example, when the command "SC,00,0l,02,04" is issued, chassis numbers (chassis identifiers) 00, 01, 02 and 04 are selected. Similarly, if the command "SC,ALL" is issued, all chassis in the system are immediately selected and all status responses are silenced. Each chassis specified by the SC command operates independently from all other chassis in the system.

All chassis in the system not selected by the SC command are de-selected.

Table 7-9 describes the syntax for the command string parameters and defines the operations performed by the SC command. Examples of the valid subsequent commands AB and AL are also shown.

Table 7-9. Request Super Chassis, SC Command String Parameters and Definitions

OPERATION	COMMAND STRING PARAMETERS	DEFINITIONS OR COMMENTS
Select Chassis and Execute Command	SC ,x ,x,x	Used in conjunction with the AB, IN and AL commands to cause multiple chassis operations. Where: SC — Select super chassis. x — Chassis address number. Range 00 through 07 and ALL are valid. Any number of chassis may be selected. Subsequent commands cause operations on the selected chassis' modules.
	SC,ALL	Select all chassis.
Request to Switch Modules	AB ,w,x,y,z#	Refer to Request to Switch Module definitions listed in Table 7-8. Where: AB - Indicates a switch request. w = namslot x = numslot y = numskip z = action (0, 1, or 2) # — Execute immediately

Table 7-9. Request Super Chassis, SC Command String Parameters and Definitions, continued

OPERATION	COMMAND STRING PARAMETERS	DEFINITIONS OR COMMENTS
Enable/Disable Alarm Status Reporting	AL,w,x,y,z#	Refer to Enable/Disable Alarm Status Reporting definitions listed in Table 7-7. Where: AL - indicates alarm status operation. w = action(0 or l) x = cardtype(15) y = startslot z = endslot # — Execute immediately
Examples:	SC,ALL AB,0,0,0,2#	Select all chassis in system. Toggle switch position of all modules in all chassis.
	SC,2,5,7 AL,1,,8,15#	Select chassis 2,5 and 7. Enable alarm reporting for modules through 15 on chassis 2, 5 and 7.

6.25 De-Select The PS Chassis (UNT)

The UNT (UNTalk) command de-selects all chassis in the system. The UNT command string does not require a command flag (# or $) prior to the string terminating characters. All command flags contained in the UNT command string are ignored by the CM software. When the UNT command executes, all chassis in the system are immediately de-selected.

Note: When a remote control device (terminal) selects another chassis in the communications system, any active chassis on the communications line is automatically de-selected.

6.26 Error Codes

The CM responds with an error message when the remote control device issues a command containing a parameter syntax error or when the CM cannot prop-erly execute the last switch command received. Error code ERR00,??? will be received when an incorrect syntax has been entered. Check the command and try again. The error message has the format:

ERRxx,nn,yyyy

Where: ERR — indicates an error message.

xx = the PS chassis identification name in the range 00-07.

nn = the type of error (error code).

yyyy = the specific error.

The error codes are:

*15,l0yy AB card yy failed to switch, where yy is in the range 00-15.

* This error will occur if a bank switch command is sent to a switch chassis which is not fully loaded with l6 switch modules.

l7,2000 If no change in status occurred in the SwitchMate System, the CM cannot execute the UP command.

18,1000 Parameter syntax error in AB command.

19,1001 Invalid action parameter in AL command.

19,l002 Invalid cardtype parameter in AL command.

19,1003 Invalid startslot number in AL command.

19,1004 Invalid endslot number in AL command.

19,1005 Startslot number is greater than endslot number in AL command.

6.27 Testing The Communications Line

Once a chassis is activated by a terminal, the user may test the quality of the communications line transmission by sending a message (test data) or random character string to the selected chassis. The test data string must include an echo command flag before sending the LF termination character. All character strings entered containing a “$” sign character and terminated with a LF, are returned to the issuing terminal. Because the selected PS chassis does not act upon data received until a GO command is recognized, no error is indicated. If a GO command is executed and the data previously sent to the chassis is invalid, the CM responds with an error message.

If the test data contains a “#” character, an error message is immediately returned to the originating remote control device.

SECTION 8: GENERAL INFORMATION

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1 WARRANTY/SOFTWARE

The Product and Software warranty policy and warranty period for all Products of ADC Telecommunications, Inc. (hereinafter referred to as ADC) is published in ADC's Warranty/ Software Handbook. Contact the Business Broadband Group (BBG) Technical Assistance Center at 1-800-366-3891, extension 3223 (in U.S.A. or Canada) or 612-946-3223 (outside U.S.A. and Canada) for warranty or software information or for a copy of the Warranty/ Software Handbook.

2 REPAIR/ADVANCE REPLACEMENT POLICY

All repairs of ADC Products must be done by ADC or an authorized representative. Any attempt to repair or modify ADC Products without prior written authorization from ADC shall void ADC's warranty.

If a malfunction cannot be resolved by the normal troubleshooting procedures, call the BBG Technical Assistance Center at 1-800-366-3891, extension 3223 (in U.S.A. or Canada) or 612-946-3223 (outside U.S.A. and Canada). A telephone consultation can sometimes resolve a problem without the need to repair or replace the ADC Product.

If, during a telephone consultation, ADC determines the ADC Product requires repair, ADC will authorize the return of the affected Product by the issue of a Return Material Authorizsationnumber and complete return shipping instructions. If service is affected, ADC can arrange to ship a replacement Product when available from designated inventory. In all cases, the defective Product must be carefully packaged to eliminate damage, and returned to ADC in accordance with issued ADC instructions.

3 REPAIR CHARGES

If the defect and the necessary repairs are covered by warranty, Buyer’s only obligation is the payment of all transportation and associated costs in returning the defective Product to the location designated by ADC. ADC, at its option, will either repair or replace the Product at no charge and return the Product to Buyer with transportation costs paid by ADC, only when ADC contracted carriers are used. Requested return of Product by any other means will be at Buyer’s cost. Buyer is responsible for all other associated costs in return of Products from ADC. If Product is Out of Warranty or NTF (no trouble found), ADC will charge a percentage of the current Product list price. To obtain the percentage factor for out of Warranty or NTF Product, contact the ADC Product Return Department at 1-800-366-3891,extension 3000 (in U.S.A. or Canada) or 612-946-3000 (outside U.S.A. and Canada).

If a service effecting replacement Product is requested, the current list price of a new Product will be charged initially. Customer purchase order is required to ship an advance replacement Product. Upon receipt of the defective Product, there will be no credit issued by ADC to the buyer for any returned Product found to be Out of Warranty. ADC will credit Buyer eighty percent (80%) of Product price charged for any In Warranty Product under the Program terms. Products must be returned within thirty (30) days to beeligible for any advance replacement credit. If repairs necessitate a field visit by an ADC representative, customer authorization (purchase order) must be obtained prior to dispatching a representative, ADC will charge the current price of a field visit plus round trip transportation charges from Minneapolis to the customer’s site.

4 REPLACEMENT/SPARE PRODUCTS

Replacement parts, including but not limited to button caps and lenses, lamps, fuses, and patch cords, are available from ADC on a special order basis. Contact the BBG Technical Assistance Center at 1-800-366-3891, extension 3223 (in U.S.A. or Canada) or 612-946-3223 (outside U.S.A. and Canada) for additional information.

Spare Products and accessories can be purchased from ADC. Contact Sales Administration at 1-800-366-3891, extension 3000 (in U.S.A. or Canada) or 612-946-3000 (outside U.S.A. and Canada) for a price quote and to place your order.

5 RETURNED MATERIAL

Contact the ADC Product Return Department at 1-800-366-3891, extension 3000 (in U.S.A. or Canada) or 612-946-3000 (outside U.S.A. and Canada) to obtain a Return Material Authorization number prior to returning an ADC Product.

All returned Products must have a Return Material Authorization (RMA) number clearly marked on the outside of the package. The Return Material Authorization number is valid for thirty (30) days from authorization.

6 CUSTOMER INFORMATION AND ASSISTANCE

For customers wanting information on ADC products or help in using them, ADC offers the services listed below. To obtain any of these services by telephone, first dial the central ADC telephone number, then dial the extension provided below.

The central number for calls orginating in the U.S.A. or Canada is **1-800-366-3891**. For calls originating outside the U.S.A. or Canada, dial country code “1” then dial **612-946-3000.**

Sales Assistance **Extension 3000**	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration **Extension 3000**	• Complete Solutions (from Concept to Installation) • Network Design and Integration Testing • System Turn-Up and Testing • Network Monitoring (Upstream or Downstream) • Power Monitoring and Remote Surveillance • Service/Maintenance Agreements • Systems Operation
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